Including Ham Radio Fun!

73 Amateur Radio Today

JANUARY 1998
ISSUE #448
USA $3.95
CANADA $4.95

International Edition

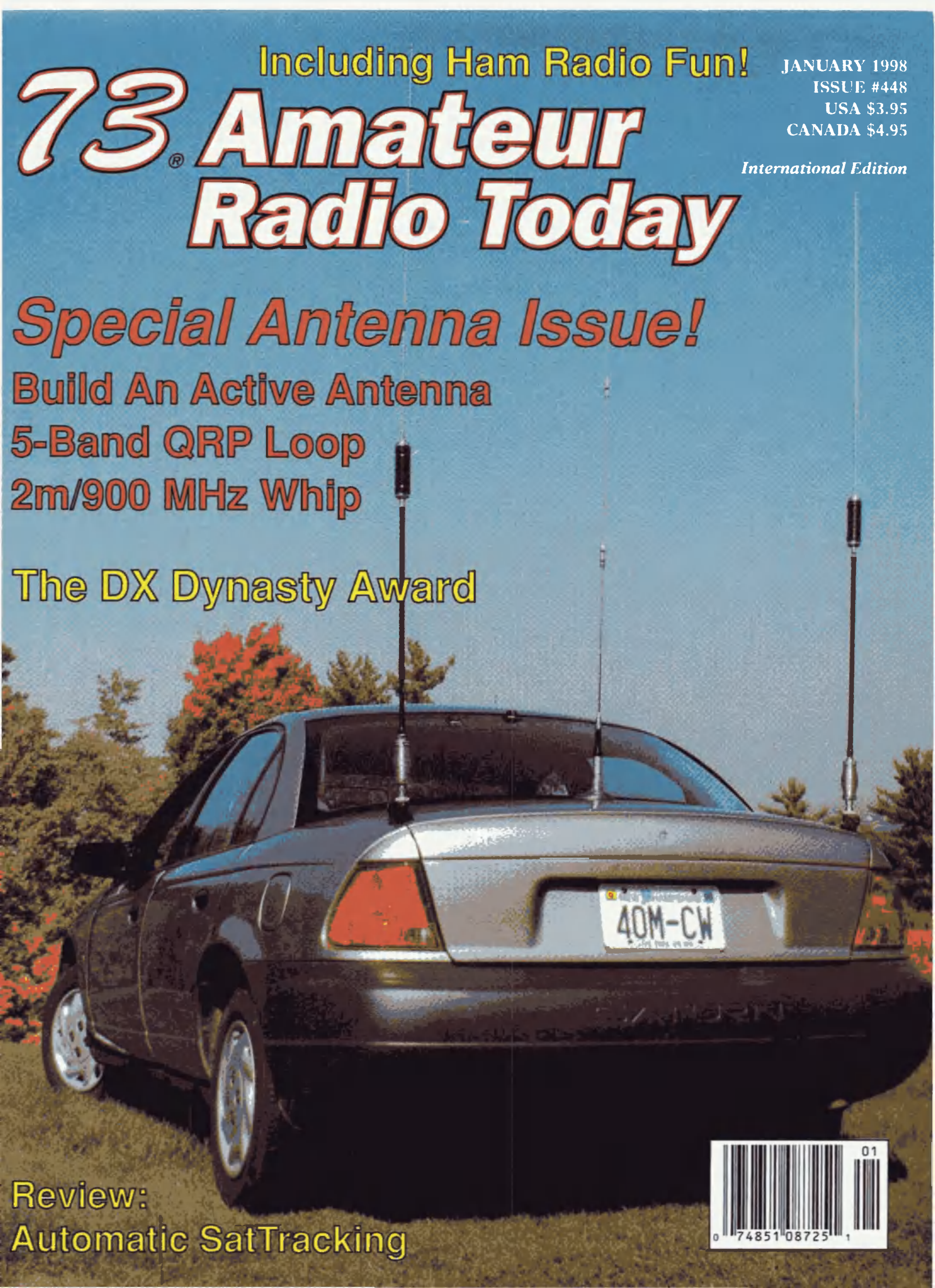
Special Antenna Issue!

Build An Active Antenna

5-Band QRP Loop

2m/900 MHz Whip

The DX Dynasty Award



Review: Automatic SatTracking

THE TEAM

El Supremo & Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
J. Clayton Burnett
Priscilla Gauvin
Joyce Sawtelle

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Jack Heller KB7NO
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister W5ACM
Dave Miller NZ9E
Joe Moell KØOV
Steve Nowak KE8YN/5
Carole Perry WB2MGP

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA by
Quad Graphics

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens must include their Social Security number with submitted manuscripts so we can submit it to you know who.

JANUARY 1998
ISSUE #448

Including Ham Radio Fun!

73 Amateur Radio Today

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

REVIEW

HAM RADIO FUN SECTION

On the cover: Carefully installed antennas and cables let Andrew Moore NV1B enjoy mobile CW and 2 meter FM without the distractions of safety hazards or messy looking wires. The choice of multiple narrowbanded 40 meter resonators and a trunk-mounted coax switch provide good bandwidth while eliminating high wind loads and antenna tuners. In classic OM form, NV1B sneaked out of the house on the morning of his wedding day to capture a little of New Hampshire's famous fall foliage atop Stratham Hill Park, site of the Port City Amateur Radio Club's 1997 Field Day operations. Our best wishes to Andrew and his new XYL!

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107.

The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Virus Attack!

I see where the Magic Kingdom® has been threatened with St. Louis encephalitis. Eleven Florida counties are on the alert, plus Long Island, Massachusetts, North Dakota and Georgia. It's those pesky skeeters, and if one gets you there's a 20% chance that you'll bite the dust. But if you don't die, you'll get awfully sick.

Why am I rattling your cage about something over which you have so little control? Because that sneaky little Bioelectrifier (May issue) might just be the key to whupping the skeeter-spread virus. If you've built one of these gadgets and are in any of the infected areas, you could do worse than try to find a doctor who is at least willing to try it. Since they have no drug or surgical measures handy to tackle the virus, maybe you can recruit an MD to at least test it on his next encephalitis victim.

The BE seems tailor-made for this emergency. But then, I'm getting all sorts of weird reports of its use—like one chap who had an abscessed tooth. He used the BE with one electrode to the toothal area and in a couple of days the tooth was no longer infected. Headaches, backaches, colds, flu, and so on are being reported aborted. If this keeps up the whole medical industry will be outraged, calling for drastic FDA measures to stop this threat to their revenues.

In the meantime the Disney folk are closing pools and water parks in the evenings and the public health department is putting flocks of chickens around the swampy areas. They test them once a week for the virus.

What, you haven't made a Bioelectrifier yet? Forsooth! Is there no end to your procrastination?

Heritage

Most of us want what's best for our kids. We want to do everything we can to make sure they are healthy and happy. Well, for some families that's true, as long as it isn't too much trouble.

One of the reasons I've weathered well and already outlived half of my compatriots has to do with my diet as a youngster. My mother cooked breakfast every morning. Cooked lunch. Cooked dinner. The kitchen was the family center. She cooked eggs dozens of different ways. There was an array of different hot cereals on the pantry shelves. White toast? No way. Jelly and jam? None. Cold cereal? I didn't get to eat that until I went away to choir camp when I was 12. Yeah, I sang in the church choir every Friday night and Sunday morning and evenings, with choir practice on Wednesday afternoons.

I never even tasted Coke® until I was in my third year of high school. Or any other soft drinks.

Dad would get furious if he came down for breakfast and mother didn't have something different. The same breakfast twice in a month would have him storming around about having the same goddamn thing every morning.

So, while the friends I've outlasted were eating com flakes, Force™, and puffed wheat, I was eating unsugared Wheatena™, Cream of Wheat™, and red flannel hash with a poached egg. Or scrapple, fried corn mush, home fries, corn fritters, buckwheat cakes, and so on.

I came home from school for lunch and it was always a hot lunch, with my mother reading to me as I ate. That may have something to do with my huge library and my reading two or three books a week. How about a slice of toast with a slice of cheese on it? Add to that a thin slice of onion and a couple strips of bacon, grill until the cheese melts and sprinkle with paprika. That's heavenly!

Cookies and milk in the afternoon? We didn't have any cookies in the house and I didn't get hungry until dinner time anyway.

One result of all this was that I had perfect teeth until I'd been in the Navy for three years during WWII. That's when I had my first filling.

So what are you feeding your kids for breakfast? Sugar-coated fruit loops? Boo-Berries? Bread and jam? Is the TV on instead of reading to 'em? Some heritage! If you want healthy kids, give them a good start with the food their bodies need. Fruits, vegetables, meat. There's a lot of evidence that if you are going to include milk, you'd better get it from a health food store. Organic. The supermarket product often is laced with the hormones and antibiotics they feed cows to improve their milk production.

Read to your kids when they eat breakfast and lunch. How many poems have your kids learned? I still remember many of the poems I learned when I was six and seven years old.

The UPS Strike

First, the strike had little to do with wages or working conditions and everything to do with a big union fighting a big business for power. The rest was just the usual smoke and mirrors.

In this time of record low unemployment what reason is there for someone to work for UPS who is unsatisfied with the pay or working conditions?

When unions were started during the depression of the 1930s they were needed. The country had high unemployment and that made it so many employers were able to take advantage of the situation and pay very low wages while maintaining terrible working conditions. But even then, people with marketable skills and education had little trouble in getting work, so the unions tended to gather the unskilled together to force employers to pay higher wages.

Naturally this quickly got out of hand and we saw many unions forcing wages far beyond their market value and keeping the wages high by preventing more people, no matter how skilled, from joining.

When I started *73* in 1960 my first printer, O'Brien Press, had a union shop, so I got to know the union workers firsthand as they worked on each issue of my magazine. The printer's union was very protective. They'd only let the sons of members join. No outsiders need apply. And the printing companies could not hire anyone but union workers. The result was astronomical wages for truly stupid and only semi-skilled workers—workers who had no incentive to either learn more or perform well since they essentially couldn't be fired. The situation was much like what I found when I went to Russia and tried to deal with clerks in the government stores.

I remember one day when

the son of the owner of the printing company was showing a visitor around and he ran a piece of paper through a small proof press. The entire union membership walked out.

Before that, I'd found the same situation in the television business. The stagehands' union was both closed to newcomers (unless family members), and protective of marginally skilled highly paid workers. On the TV set, if the director dared to move a lamp on a table on a set, the stagehands would go on strike because he touched a prop.

It was well known on Broadway that on Friday if the stagehands weren't paid before the start of the last act of a play, the play would not be allowed to go on. And paid in cash. None of this check business.

Maybe you remember the featherbedding of the rail unions.

No one has been holding a gun to the UPS workers' heads, keeping them from quitting. If they could get better pay and/or working conditions elsewhere, they'd be out of there.

Companies, as far as I know, have no responsibility to pay people more than they're worth just because the worker *feels* it is "owed" to him. If he's really worth more, then he should find an employer he can convince of that. And keep the employer convinced.

As someone who has had over a thousand employees over the years I can testify that very few of them, despite my best efforts at recruitment and subsequent encouragement, ever made any serious effort to be really outstanding at their work. Most did the least they could get away with. Unless watched they would come in late, leave early, and take amazingly long lunches. The bottom line for me was that I had to hire ten people to do the work of maybe five.

The few employees who took advantage of the learning experience I offered them have done very well. The others I run into now and then, still working at some stupid job and still doing as little as possible.

It is pathetically easy to be better at what you do than 90% of those around you. Make that 99%, and it's still low.

I went to work at WPIX-TV in New York as an engineer. It wasn't long before I was chief cameraman. But then no one else on the engineering staff made any effort to learn and build their skills. I left there to become a director at KPIX in San Francisco. At WXEL in Cleveland I directed all of their network originations.

You are the one in charge of your fate, not your boss. If you need the brute force of a union to get more pay, you're lazy and unmotivated.

New Licenses

The FCC's figures for August 1997 show a drop of 94% in just the last two years in new General and Extra Class licenses. The new Advanced Class licenses dropped by 91%. Fortunately, the number of Techs upgrading to General only dropped by 42% in the same period. Which means, I suppose, that the ARRL Directors' sneaky plan to eliminate QRM on our HF bands is working. And just in time, too, what with the sunspots expected to get things back into action on what is projected to be one of the most active sunspot cycles in history.

Well, QRM has been the bane of HF operation ever since hamming started, so I, for one, will be delighted to not have to worry about it any more. But we hams will always be complaining, only now it'll be about those damned three-station pileups on rare DX.

When the last active ham in Wyoming dies will we be seeing Japanese DXpeditions going to Wyoming for the tens of thousands of young Japanese state hunters?

As an old 20 m fan, I'm beginning to appreciate the ARRL's single-minded insistence on maintaining the CW Great Wall to keep what few newcomers we're attracting to the hobby up there on 2 m and keep the HF bands for us old timers. But then amateur radio has always been primarily for old men, right? OMs. Oh, we old men dream about young ladies (YLs), but when's the last time you heard one on 20 m? I worked an OL on 20 m back in 1965. I'd been on the frequency for a couple of hours making contacts when she broke in and told me to get the hell off there, that it was the YLRL's frequency. Sigh. Hi, Evelyn, remember that one? I was operating from PJ3CC.

Speaking (well, writing) of newcomers, how're we doing on new no-code Techs? Pretty good—they've only dropped off 61% in the last two years.

Are You Ready?

A while back I suggested that it would be prudent for hams living around our major cities to get serious about setting up emergency communications systems. Now comes news that the Soviets are missing around a hundred of their suitcase-sized nuclear bombs. Of course they're only kiloton devices, not like the 10-kiloton bombs we dumped on Hiroshima and Nagasaki, so they would probably only blow a medium-sized hole in a big city, plus wipe out a few million people with the radiation. And probably also wipe out any solid state electronic equipment for a few miles around with its EMP pulse.

There is no shortage of groups pissed off at us who might want to smuggle such a suitcase into downtown Manhattan and put an end to Wall Street, or maybe try to do us a big favor by wiping out as much of Washington as they could. It might take two suitcases to take care of the Pentagon and the Congressional buildings, but that could still leave the CIA HQ in Langley intact. Say, where's the IRS HQ? Oh well, that's a self-serving thought and not worthy of me.

You're going to need a mobile command station with a portable repeater and as many still working HTs as you can find. And the more you're able to intercommunicate with other services the better. And don't forget some Geiger counters.

In the case of New York, fortunately very few hams live in downtown Manhattan, so most hams, living in the other four boroughs and on Long Island, could survive the blast. But it's going to be a communications nightmare.

The cell phone and telephone systems will probably be out of commission for months, depending somewhat on how high up the bomb is exploded.

Is there a danger to Cleveland, Chicago, San Francisco, Atlanta and other major cities? With a hundred missing bombs and guys like Saddam Hussein and Qadafi with both the money to buy them and the means to set them off anywhere they want, who knows? North Korea is mad at us too, and something like this might keep us busy enough to let them invade South Korea again.

But even groups who haven't managed to buy a bomb could demand ransom to not set off a bomb that they just might have. That's a very attractive business proposition.

I'm willing to bet that, despite the danger, I won't see one single hint of any effort by ham clubs in or near our major cities making any effort to improve their emergency communications capabilities. I'll be watching the club newsletters, hoping that I'm wrong.

ET Mischief

A local paper ran a story about a cylinder-shaped UFO that hovered over Hinsdale NH one night. A little later a nearby farmer went out to the barn to feed his cows and found all 25 lying dead. An autopsy found they'd all been electrocuted, yet their hooves were intact, showing that they hadn't been struck by lightning, which splits the hooves. The barn showed no sign of any damage.

Continued on page 7

LETTERS

From the Ham Shack

Ten-Tec, Inc. Rebuts

In October. we published "Where's the Manual?" by David Thompson K4JRB. We have just received this bulletin from **Scott E. Robbins W4PA**, Ten-Tec, Inc.'s Amateur Radio Product Manager:

"Mr. Thompson states 'Newer manufacturers only offer manuals for about three to five years after the product is obsolete ...' For Ten-Tec, this is not the case. We sell manuals for every piece of amateur radio equipment we have built, going back to when we first started manufacturing ham gear in 1968. We also service all gear ever manufactured by us, a claim no other transceiver manufacturer can make. We will continue to offer both manuals and service for all of our equipment, as we have done every day for the last 30 years."

That kind of reliability is increasingly rare these days ... Ed.

Les Oliver, Sacramento CA. Yes, I'm finally getting around to ordering some of your recommended books. Your editorials in *73* are always interesting, but, good grief, sir—you seem to try to encourage people to actually think. What an appalling concept! If too many people start to think and reason for themselves it could cause chaos. Just try to imagine what it would do to our political and educational systems alone (insert large, slightly sinister grin). On the subject of education, college was certainly interesting, but not particularly applicable to any portion of the real world which I've yet encountered. I worked in my original field for just over six months before deciding that I would wind up a *lot* crazier than I wanted to be. Since then I've built musical instrument amplifiers, done consulting, quality control, some time with Uncle "keeping the world safe from democracy," managed a steel fabrication mill, and am currently working in wholesale/retail sales of surplus electronics. As an aside, an Army psychologist once told me that the two career fields that I should *never* enter were sales and cooking. It's nice that I don't trust "experts," even iffen i are won. Enough aimless meandering. Keep up the good work.

Dr. Melvin Carlson, DDS N7RNG. I know you are interested in education, so permit me to contribute to your edification and challenge some of your statements in the October *73*. I can't say I was surprised by your shrill denunciation of fluorides. I have nothing against informed opinion, but I must remind you that misinformation not only refutes your point, but makes any other statements you make suspect. I'll be interested in laying my eyes on the study showing 480,000 children suffered a doubling of tooth decay while consuming the optimum amount of fluoride in their drinking water. I'd also like to see the documentation of the statement that an additional 60,000 people died of cancer as a result of optimum fluorides.

I am not aware of published evidence that 1 ppm causes severe allergic reactions and destruction of the immune cells. Obviously there are allergies that occur to any element in our environment, but to accuse anyone of hiding facts on fluoridation from the public borders on hysteria.

After practicing pediatric dentistry for almost 50 years I have personally witnessed the decline in tooth decay in kids to a remarkably low level. This reduction has occurred gradually since the introduction of fluorides in this country.

After reading your editorials I am amused, entertained and occasionally enlightened. If I knew as much about radio as I do about the benefits that fluorides provide, I would be as smart as you!

Thanks, Doc, but have you really done your homework, or have you bought the ADA party line, hook and sinker? For instance, a 1985-86 study of 39,207 American children aged 5 to 17 by the National Institute of Dental Research concluded that the children drinking fluoridated water have almost identical rates of tooth decay to those not drinking fluoridated water.

Dr. Whitaker's Health and Healing, *September 1997 issue, devotes over two pages to destroying the fluoridation myth. It also references a larger New Zealand study which reached a similar conclusion, and a 1987 Canadian study showed lower decay rates in provinces without fluoridated water.*

The report cites 11,000 calls per year to poison centers because children have ingested fluoridated toothpaste.

Japan and most of Europe have studied the situation and opted against fluoridation of their water supplies.

For a more complete report on the subject please read Fluoride, The Aging Factor, *which is reviewed in my* Guide to Books You're Crazy If You Don't Read. *The author, with whom I've corresponded, provides 46 pages of references to published papers. I've done my homework on this: now it's your turn to get busy. You can get more information from Citizens for Safe Drinking Water, 3243 Madrid St., San Diego CA 92110; (800) 728-3833. Also, when I wrote about it in my editorial I offered to make photocopies of three pages of references on the subject. A couple dozen readers requested them. Say, have you read the Procter & Gamble study of chromosome damage caused by fluoride? At 1/2 ppm they found 6% of the cells in the study had chromosome damage. Is that what you want for your kids? It seems that fluorides also disturb DNA repair and synthesis. ... Wayne.*

Louis M. Barrio KE6DKI. I really enjoy your column, "Never Say Die." It's provocative, controversial, and sometimes even humorous. Keep up the good work!

A recurring theme in your monthly column is how our hobby is fading away. I must give credit to Henry Ruh's article in the September '97 issue. His proposal for modifying the ham licensing structure is the first truly well thought out idea I've seen yet. While I think the requirements for license upgrading are a bit too stringent, overall he's right on target. Mr. Ruh's proposal would make hobbyists become active in the hobby and show real intent to upgrade. Upgrading would be an achievement- and learning-based process. This is, in my view, a better approach than the current system which encourages rote memorization and the learning of an archaic skill (Morse code) with virtually no use outside ham radio. What's more, it would give new hams an opportunity to get a real taste of what hamming is all about. Under Mr. Ruh's proposal there would be real incentive and opportunity to experience modes and bands beyond 2 m and 440 MHz. It would probably also encourage learning about antennas, electronics, propagation, and maybe even doing some kit building.

I think Mr. Ruh's proposal is far better than the alternative, that being arguing over preservation of the code requirement or lowering the required code speed, among other things. Meanwhile, our precious band allocations are being sold off or allocated to other uses and the ARRL (Archaic Radio Restoration League) sits and does little more than whine about the entire situation. When is the ham community going to awaken from its

NEVER SAY DIE

Continued from page 5

A later check with a Geiger counter showed high radiation where the cows had lain, and also where they were buried. And the following year the corn planted where the cows had been buried formed a perfect circle and turned brown and died when it was about six inches high.

More ETs

Put yourself in the position of an ET visiting Earth. The fact that you're able to visit the planet, which is thousands to millions of light years distant, guarantees that your technology is at least thousands of years ahead of ours on Earth. Suppose you could travel back 50,000 to 100,000 years and look at the civilization Earth had at that time. Would you land and look for a welcome from the people you find? At that time they hadn't even developed farming, much less towns or cities. And then, not too different from today, they were busy killing anyone who might be an enemy.

Well, it probably isn't much different for a civilization that's many millennia in advance of ours. So I suspect that many advanced races come here every now and then, take a look at how we're doing, maybe give us a little nudge, and that's that.

With some 50 billion solar systems in our galaxy, and with many probably having planets, since the same forces that form suns seem to also allow planets to form, and since most of 'em are a lot older than our solar system, the odds are that we're not hundreds or thousands, but perhaps millions of years behind millions of ET races. And that's just in *our* galaxy.

Considering all that, the surprising thing would be if we were not being visited by advanced races, and it would be more surprising still if they bothered to communicate more than with an occasional person, and they probably would erase any memory of that.

As a small Roswell note, the GAO, in 1995, tried to review the Army records of the Roswell Army Air Field and found that the pertinent records from 1946 to 1949 had all been destroyed—without authorization.

Roswell Echoes

If you are either brainwashed by the media or just not keeping up with events, the Col. Corso book, *The Day After Roswell*, written by an ex-top Pentagon official, claimed that he had seen an alien body, plus an Army autopsy report on the alien, and had been put in charge in the 1960s of integrating alien technology recovered from UFO crashes into our industries. Now another player from the 1947 era has come forth. The UFO (or more probably, two UFOs) crashed in July 1947 in New Mexico. By September of that year the first integration of the alien technology recovered from the crashes had already made its appearance.

This new chap, interviewed on the Art Bell W6OBB show, claims that the transistor was not invented by Shockley and his two pals at Bell Labs in Murray Hill (NJ), but was reverse-engineered by them from the UFO recovered artifacts. So much for their Nobel prize for the invention.

Further, this chap attributes the development of ICs, digital signal processing, lasers, modems, nuclear-powered engines, and imaging devices to the recovered alien technology.

Well, maybe the artifacts helped, but I was around when modems started and I don't recall any unexplained jumps in technology. Ditto ICs.

ICs were a natural development. When transistors made smaller circuits possible we first went to wired circuit boards, then to printed circuit boards, and finally to combining the transistors and circuits into integrated circuits, with each step shrinking the module size.

Heck, we were using RTTY modems in amateur radio in 1947. I got involved in 1949 and John Williams W2BFD had this technology well developed by then. Of course it took us a panel full of 6SN7GTs to do all of the work. I've still got a panel out in the barn that I built to connect my Model 12 Teletype machine to my ham rigs. I operated mostly on 2 m, but also made a bunch of 11 m contacts and even worked California on 80 m, back when the ARRL was still doing its best to keep FSK off the HF bands—worried that 60 wpm RTTY might put their CW traffic nets out of business.

The attribution to alien technology for our development of nuclear powered engines also doesn't make timeline sense to me. We developed the atom and hydrogen bombs in 1945, so we had a fair handle on nuclear power by 1947. And I haven't seen any hint that UFOs are nuclear powered anyway. Their powering technology seems to still be hundreds of years still ahead of us. Or more.

Any introduction of alien technology should be visible by sudden jumps in our technology, and most of our technologies have not shown such jumps. Except for transistors and fiber optics—although I was playing with glass filaments which I made in 1934, drawing out glass rods into long filaments. And I noticed how the glass allowed light to go through, even when it was bent. I had a lot of fun making tiny glass tubes by drawing out the Novocain tubes I got from a dentist friend.

There was no sudden jump in our move to digital communications. Our RTTY FSK signals were digital, with a start pulse, five data pulses, and a stop pulse. And that's not much different from ASCII, with its eight data pulses and an added parity

Continued on page 81

---

current stupor and realize the time to act is *now*? We can save our hobby. I think the first step is to get behind constructive proposals like Mr. Ruh's and get the FCC and the ARRL to act on them. So OK, Mr. Ruh's proposal isn't perfect, but with some modification, and more importantly its adoption, hams would be taking a giant leap forward in saving our grand old hobby!

Ozzie Levin W5RK. I met you in Chicago way back in the 1930s at a ham convention. I have followed your career and subscribed to your *73* magazine and read all your editorials and enjoy them immensely. I have been a ham for over 60 years, but believe me I am in complete agreement with you on eliminating the code. We should do everything within our power to overturn this detrimental portion of the ham exams. I have taught ham radio classes for over 40 years, both at the local high school and my home. I am proud to say that I have turned out a large number of hams who have gone into the electronics industry as teachers, engineers, etc. Like you I have an inquiring mind. Having worked with pyramids, the Hieronymous machine, and built my own version using transistors, I also found the battery could be disconnected and it would still work, and by the way, after experimenting with pyramids, trying to find out what made them work, I discovered that they are affected by sunspot activity. During this low cycle experiments do not always work. I built most of the mind machines you mentioned in your last issue and they all work. So, to the scientific community and the rest of the doubting Thomases, you'll never know and that's too bad. There are many things in this world of ours that we cannot perceive with our five senses. Wayne, just wanted to say thanks for all your editorials and insight into things not necessarily related to ham radio.

QRX . . .

Which Form Was That?

The FCC has released a new Form 610, dated March 1997, which, among other minor changes, includes a space for your E-mail address. The form is available via the FCC's Internet site or through normal channels.

The Environmental Impact question has become a statement in which the applicant certifies that "the construction of the station would not be an action which is likely to have a significant environmental effect." According to the Gettysburg FCC office, they will continue to accept the three different Form 610s (dated Nov. 1993, Mar. 1995, and Mar. 1997) until further notice.

From *The Modulator*, newsletter of the Fort Myers (FL) ARC, September 1997.

Students Have Radio Link to Space

Augusta, ME: Augusta schoolchildren will talk to astronauts passing hundreds of miles overhead in the next few years, thanks to a five-year collaboration between schools and local amateur radio enthusiasts.

Cony High School teacher David Garippa hopes that three to five minutes of communication will open the eyes of students to the power of the rapidly growing world of communication technology.

From Cony's communication room—a small second-floor room packed with radio equipment and computer monitors—students can communicate with amateur radio operators anywhere in the world, or track the movement of satellites with equipment that has largely been donated.

Garippa said the effort started with the idea of putting the latest technology into the hands of students.

"We want to provide Augusta kids and adults—whoever wants to use it—with a place where they can learn new communication technology," said Garippa. "Communication technology is one of the most important and fast-moving technologies in the world."

Beginning in 1992, community sponsors, including the Augusta Amateur Radio Club, have donated radios, antennas, and the expertise to teach students how to use the equipment.

One computer in the communication room tracks the positions of satellites and shows students the view from the satellite's "back window," or space side.

A digital packet radio donated by the club allows students to connect to the space shuttle.

Recently, one of Garippa's classes used that radio to listen to a transmission from the Russian space station *Mir*, and heard a visiting American astronaut discuss the experiments of the day.

"We are trying to give something to the community—give the kids something to do that is constructive and pay back the community," said Richard Beausoleil.

Beausoleil, president of the Augusta Amateur Radio Club, said amateur radio not only provides an academic component, but also gives young people a chance to play an active role in the world around them. In times of emergency, amateur radio operators can perform vital tasks.

For example, when floods wiped out all normal communication recently in Grand Forks, North Dakota, ham radio operators provided emergency communications, and even dispatched for the fire department, he said.

"It teaches them digital communications and also it fine tunes their computer skills," Beausoleil said. "And it is fun."

Paul LeClair, a member of the radio club, applied to SAREX, the Shuttle Amateur Radio Experiment, on behalf of Cony in the fall of 1996, according to Garippa. The application was accepted in February 1997.

Since 1992, the AARC has donated equipment to the school and instructed students in its use. "We wanted to take them on," said LeClair. "We wanted to take them under our wings. You have got to have good radio gear. You have got to have good antennas and you have got to have, hopefully, a room full of kids," LeClair added.

Garippa said he hopes to make the link-up a citywide event.

Students from any school in the city, including private schools, can participate, according to Garippa, although strict time limits will be enforced because of the short amount of time when the shuttle will be in range.

Cony is now offering a class for amateur radio licensing.

From an article by Alan Crowell, in *The Kennebec Journal*, May 31, 1997.

Transceiver Ad Translations

ADVANCED DESIGN: Upper management doesn't understand it.

ALL NEW: The plugs, jacks, and connectors aren't compatible with anything else on the market.

BREAKTHROUGH: We ignored everything we learned in developing the previous design.

CUTTING-EDGE TECHNOLOGY: Designed around a bunch of free samples from a salesman. He claims the production units will work just like the samples.

DESIGN SIMPLICITY: It was developed on a shoestring budget.

ENERGY EFFICIENT: Almost unmeasurable power output—you'll need a linear to work anyone but your next-door neighbor.

EXCLUSIVE: We're the only ones who have the documentation.

FIELD TESTED: Manufacturing doesn't have a test system.

FOOLPROOF OPERATION: We eliminated almost all of the controls.

FUTURISTIC DESIGN: The mold for the plastic case got screwed up—that's why it looks so weird.

HIGH ACCURACY: But the display only shows three significant digits to keep the cost down.

ISO-9000 CERTIFIED: We have *no* idea what this means, but our competitors claim they meet it, so we probably do, too.

IT'S HERE AT LAST: We've released a 26-week project in 48 weeks.

MAINTENANCE FREE: It's impossible to fix.

MEETS QUALITY STANDARDS: The on/off switch almost never breaks. We haven't checked the rest of it yet.

MIL-SPEC: From the folks who brought you $600 toilet seats.

MODERN SUPPLIERS: The IC in the RF output stage is available solely from a supplier in Bangladesh.

NEW: It comes in different colors than the previous version.

PERFORMANCE PROVEN: The breadboard worked really neat.

REVOLUTIONARY: The knobs go round and round.

SATISFACTION GUARANTEED: We'll send you a replacement unit if you don't like it.

STOCK ITEM: We shipped it once before, and we can do it again, probably.

UNMATCHED: It's almost as good as the competition.

UNPRECEDENTED PERFORMANCE: Nothing ever had as many out-of-band harmonics as this unit.

YEARS OF DEVELOPMENT: We finally got one to work.

TNX to *ARNS Bulletin*, September 1997.

Substitute in Space

Astronaut Andy Thomas is studying for his ham ticket in anticipation of spending several months aboard the Russian *Mir* space station starting in January 1998. He'll replace Wendy Lawrence KC5KII in the *Mir* rotation. Lawrence was originally supposed to replace Mike Foale KB5UAC aboard *Mir* in the autumn of 1997 but in the wake of the problems aboard the space station over the past few months, however, NASA determined it would prefer to have an astronaut aboard *Mir* who could fit the Russian space suits—in case an astronaut needed to participate in a space

walk as Foale had to do during his *Mir* stay. Lawrence is too small to wear the Russian space gear, and that same thinking could have been behind swapping Thomas for Lawrence on the subsequent *Mir* posting.

Thomas, a native of Australia, is 45 and single. He holds a Ph.D. in mechanical engineering, and he became an astronaut in 1993; his first space flight was aboard *Endeavour* in May, 1996.

From an article in *Badger State Smoke Signals*, October 1997.

Extra Certificates Discontinued

The Amateur Extra Class certificate that has been available through the ARRL Awards Branch has been discontinued. However, some stock remains, and applications will be accepted while blank certificates last. Send a copy of your Amateur Extra license and a check for $5 to: ARRL Awards, 225 Main Street, Newington CT 06111.

TNX Chuck Hutchinson K8CH; from *Badger State Smoke Signals*, October 1997.

The Dr. Is Destinated: More Questions & Answers for the New Ham

Q. I don't have a tape player or computer, but I do have a VCR. Short of listening on the air, what's the best way to learn CW?

A. Short of listening on the air, what do you want to learn CW for? But seriously, *QST* would probably tell you to use your VCR to make a pirate (stolen) copy of your friend's Morse tapes. We say why steal a copy of the tapes? Just go ahead and steal everything he's got.

Q. I have a 486 computer that used to be a 386. Now it locks up after a few minutes and I have to turn it off and wait for a while. What's wrong with it?

A. Looks to me like you may have written to the wrong magazine.

Q. Why can't I call "CQ" on the repeater?

A. That question is not as dumb as it sounds, because there are lots of new hams who don't know the first thing about hamming. You use your two-meter ham to call the repeater right? CQ is for HF, so if you call CQ on the repeater, a lot of HF stations will answer. Unfortunately, you will not be able to hear them because they are using their HF ham which is incompatible with your two-meter. You will have much more success if you ask whether anyone has their ears on, or if anybody has got a copy.

Q. If radio waves travel like light, how come the radio works at night when light doesn't work at all except for the moon and such?

A. Beats me. Probably you are just hearing radio signals that are left over from the daytime. There is a theory called Transverse Temporal Gray Line Ducting which says that since radio waves travel at the speed of light, they can borrow time from tomorrow, sometimes. That would probably explain it.

Q. I've been wondering, just what are you a doctor *of?*

A. In the interests of confidentiality and privacy, my identity and credentials have been withheld. Suffice it to say that I am just as much a doctor as you are a ham.

Q. Am I the tallest ham in the world? And why is it important? Every day I hear guys talking about how tall they are, and most of them are like 5-5 or so, and I never heard of one that was taller than 5-9. I'm 6-3 but they STILL say I'm 5-9. What's the story?

A. In the olden days, hams used to believe in a thing called a Code of Conduct. One of the provisions of the Code that is still practiced by many is that "The ham is modest. He does not brag on the air." That's why you often hear guys say things like, "I'm only running a kW," when in fact they are running 3 kW. You shouldn't brag about your height any more than you should brag about your equipment. As for why it is important, the way your HT hits the repeater is directly proportional to the distance between your mouth and the ground, which is in turn related to your height. But do keep in mind, it's not the height or width or length of your equipment: It's how you use it.

Q. Last month you made a joke at the expense of a person who was asking a serious question. I think that's rude. I thought hams were supposed to be polite.

A. Only on the air. Get lost.

Q. I'd like to get myself a new ham. What is the very best one to get? Should I get a two-meter ham or one that has more meters?

A. Different people will tell you different things, but I will tell you this: The absolute very best rig you could possibly get would be the Colorado QRP Club's "QRPpp Special." It works equally well on all bands, and the CQC actually guarantees that you will be able to talk to everyone in the world who wants to talk to you. By the way, we usually say rig instead of ham. Rig is easy to remember because it also means truck. Ham is more commonly used to mean your ticket, which also has a trucking connotation. [Ed. Note: The "QRPpp Special" is a wooden HT awarded to a member for a "conspicuous foul-up," and is guaranteed legal on all bands.]

The Doctor will answer the most interesting questions from readers. Questions may be edited for length and clarity, which is why many of them disappear altogether. Address your questions to The Doctor, in care of this publication.

Author anonymous; TNX *Low Down*, official journal of the Colorado QRP Club [cqc@aol.com].

Repeater vs. Repeater vs. FCC

One repeater group that says another repeater is interfering with its system has filed a petition with the FCC for the issuance of a "show cause" order aimed at getting the alleged interferer off the air. The Monmouth County Repeater Association of Asbury Park, New Jersey, says that the issue is that of codifying amateur radio repeater coordination and the right to operate a coordinated repeater free of interference from an uncoordinated one.

The Monmouth group operates 2m system WB2ABT on 146.645 out. Another group, called SPARK and located in Bangor, Pennsylvania, uses the same frequency pair for WA3MDP about 100 miles away. Each is serviced by a different coordinating body, although Monmouth contends that SPARK is uncoordinated—which SPARK disputes.

In December 1996, the FCC ordered SPARK off the air. Their response was to request an investigation into whether the Monmouth group and its coordinator had conspired to misrepresent facts to the Commission.

Monmouth raised the stakes by hiring Washington communications attorney John McVeigh KD4VS. In addition to the show cause request, McVeigh has asked the FCC to rule on two other important issues: Does volunteer coordination hold any legal standing? And, Will the Commission enforce its rule that the burden of responsibility for clearing up interference between a coordinated and an uncoordinated machine lies with the latter?

So, in essence, the MCRA is taking the role that you would think the National Frequency Coordination Council or the ARRL would assume, in trying to get the Commission to state, once and for all, unambiguously, whether there is a need for repeater frequency coordination in the ARS.

No matter what the FCC decision, this small club in New Jersey has positioned itself as the *de facto* single point of contact on repeater matters, at least as far as the FCC is concerned. That sets a precedent that one day will affect the day-to-day operation of every repeater in the United States.

Many thanks to *X-Mitter*, newsletter of the Penn Wireless Association, October 1997.

Get Active!

A nice amp project for building your own active antenna.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

An antenna of any kind, passive or active, is a conductor (radiator) immersed in an electromagnetic (EM) field that converts the intercepted EM radiation to a voltage or current that can be used by the receiver. A passive antenna is just the radiator; an active antenna is a radiator plus transistor(s) and other circuitry that matches the radiator to the load.

Electromagnetic fields are described in terms of volts or amps per meter, so the dimensions of the antenna determine the volts or amps that appear at its terminals. To confound the issue, the antenna's dimensions relative to a wavelength also determine the impedance of the source of voltage or current. The impedance of the antenna is resistive (resonant) only for particular lengths. The longer the antenna, the higher the maximum available power output, but for some dimensions it is very difficult to obtain the power that is available. For example, a full-wave dipole has a high impedance that is difficult to match. In short, bigger is better—but with reservations.

When we are stuck with a small antenna, we can't afford to waste any of those precious few microvolts of signal because of mismatch. We want and need them all. The active antenna described in the following paragraphs losslessly matches a short antenna to the receiver. Its output is only 18 dB less than a full-sized half-wave horizontal or quarter-wave vertical antenna. The theory and design equations are given so that the effects of a particular situation can be understood and to allow the circuit to be adapted to use the components available.

The maximum available power from any source is obtained when the load presents a conjugate match to the source. The maximum voltage from a source is produced across an open circuit even though no power is delivered to an open circuit. A conjugate match occurs when the impedance of the load equals the impedance of the source with phase shifted 180°. That is, the resistive part of the load impedance equals the resistive part of the source's impedance and the reactive part of the load impedance equals the reactive part of the source's impedance—but with opposite sign. With opposite sign reactances, the net reactance is zero and the circuit is resonant. To realize an open circuit requires the reactance to be resonated and the resistance across a parallel resonant circuit to be infinite.

A short antenna, one that is a small fraction of a wavelength, has a resistive part that is small and a reactive part that is high. For example, a short centerfed dipole has a radiation resistance of:

$$R = 20\pi^2(L/\lambda)^2 = 197(L/\lambda)^2$$

where L = the length of a very short centerfed dipole
and λ = the wavelength, in the same units as L.

A six-foot vertical whip over perfect ground is equivalent to a twelve-foot dipole. At 7 MHz, a six-foot whip has a radiation resistance of about 1.4 ohms. At 3.5 MHz, the radiation resistance drops to 0.35 ohms. The reactance of a vertical six-foot whip made of #8 AWG (0.125" diameter) wire with the bottom located a foot or so above ground looks like 15 or 16 pF. The capacitance of a six-foot vertical made with #24 AWG (0.02" diameter) wire looks like 12 or 13 pF. The capacitance is dependent only on the physical dimensions of the antenna, its

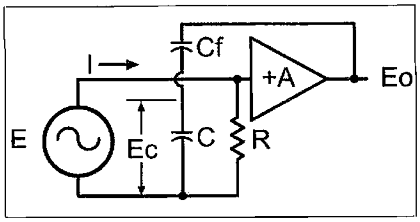


Fig. 1. A negative capacity can be generated.

diameter and length, and its proximity to grounded objects. The capacitance is independent of frequency but the reactance varies inversely with frequency:

$$-jXc = 1/(2\pi fC)$$

At 7 MHz, 15 pF has a reactance of about -j1500 ohms; at 3.5 MHz, the reactance is about -j3000 ohms. The impedance of the six-foot whip at 7 MHz is 1.4-j1500, $1500\angle-89.95°$ in polar form. A conjugate load at 7 MHz has an impedance of $1500\angle+89.95°$, which is equivalent to 1.6 MΩ in parallel with +j1500.

Converting from impedance to admittance can be laborious. However, if the ratio of resistance to reactance, or reactance to resistance, is 50 or greater, the smaller term can be neglected: 1.4-j1500 is essentially -j1500 or $1500\angle-90°$ and resonates with +j1500. In theory, an inductor could produce a reactance of +j1500 but a practical one has a significant and unavoidable resistance. An inductor also must be variable to resonate the varying capacitive reactance. +j1500 can be obtained with a negative 15 pF and its reactance varies along with the antenna's reactance.

A negative capacitor is not something to be bought at the local electronic parts store, but it is something that can be generated with a simple circuit that uses commonly available parts. The conceptual circuit shown in **Fig. 1** generates a negative capacitor. The resistor R represents the input conductance of the amplifier and losses in the circuit board; C is the sum of the antenna's capacity, the input capacity of the amplifier, and stray circuit capacity. C_f provides feedback from the amplifier's output to the input. The amplifier has a voltage gain of +A, as the output is in phase with the input.

The generation of a negative capacity can be followed with **Fig. 1**: When the junction of C and C_f is disconnected from the input, the signal current I flows only into R and the voltage E at the input to the amplifier is IR. The output of the amplifier E_o is AE and the voltage E_c appears at the junction of C and C_f. If C_f is chosen so that $E_c = E$, then when the junction of C and C_f is reconnected to the input terminal, no current flows from the signal source into these capacitors and the effect of C is removed. C_f and the amplifier produce a negative capacitor that is equal to C:

$$-C = C_f(A-1)$$

Equation 1

The negative capacity generated is dependent only on A and C_f.

A practical non-inverting amplifier is shown in **Fig. 2**. The gain is determined by the ratio of R_c to R_s and the voltage gain of the source follower VG_{sf}.

$$A = VG_{sf}(1+R_c/R_s)$$

Equation 2

VG_{sf} is the voltage gain from the gate to the source of Q1. A source follower is often assumed to have a gain of unity but, in fact, it is always somewhat less than unity. The gain depends on the value of R_s and the effective transconductance G_m of the amplifier. The effective transconductance is the change in current in R_s for a change in gate voltage. Since the base current of Q2 is the drain current of Q1, and collector current is $I_B h_{fe}$, $G_m = g_{fs}h_{FE}$. Only when $G_m R_s$ is much greater than one does the gain approach unity. The voltage gain of the source follower can be expressed as:

$$VG_{sf} = G_m R_s/(G_m R_s+1)$$

Equation 3

R_s and I_c determine the DC operating point of the amplifier, $V_{gs} = I_c R_s$. The negative feedback provided by R_s stabilizes the operating point of the amplifier and makes the amplifier immune to changes in supply voltage as well as tolerant of the characteristics of the transistors. If a change were to increase I_c, V_{gs} would increase, which would decrease I_D, which would decrease I_c. The negative feedback reduces the output impedance, reduces the input capacitance of the Q1, and increases the output bandwidth.

The relationship of the JFET's parameters are given by Evans in *Designing With Field-effect Transistors:*

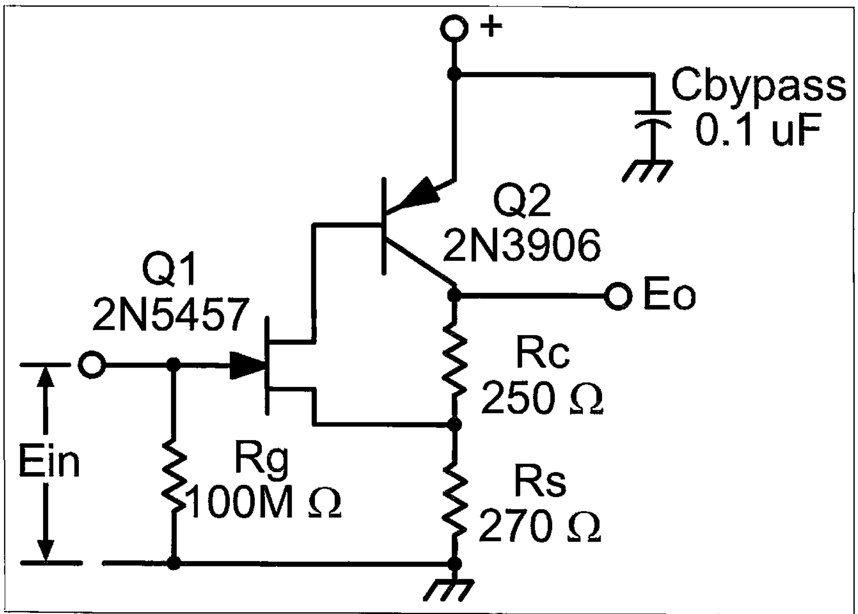


Fig. 2. A practical non-inverting RF amplifier can be very stable.

$I_D = I_{DSS}(1-V_{gs}/V_{off})^2$
$g_{fs} = 2I_D/(V_{gs}-V_{off})$

The DC operating conditions of the transistors in the amplifier shown in **Figs. 2** and **3** are: I_D = 50 uA at V_{gs} = 2.66, g_{fs} = 2.5 x 10-4, I_c = 10 mA, h_{fe} = 200 at I_c = 10 mA. The effective transconductance is:

$$G_m = 2.5 \times 10^{-4} \times 200 = 0.05 \text{ S.}$$

The negative capacity generator shown in **Fig. 3** shows the receiver's input resistance shunting R_s. The resulting RF value of R_s is R_{srf}. When the receiver's antenna input impedance is 50 Ω, R_{srf} is about 42 Ω and VG_{sf} is about 0.68. However, if the receiver's input impedance changes with frequency, then the negative capacitance also changes. When the negative capacity is excessive, the net capacitance at the gate of Q1 is negative and the circuit will oscillate at the frequency at which the vertical radiator is approximately a half-wave long.

In **Fig. 3**, the value of C is assumed to be 30 pF, which is composed of the antenna's 16 pF, the amplifier's 2 pF input capacitance, and 12 pF circuit strays—for a total of 30 pF. The negative feedback provided by R_{srf} reduces the input capacitance of Q1. C_f is arbitrarily chosen to be 15 pF. With **Equation 1** the amplifier gain needed to generate -30 pF when C_f is 15 pF is 3. The uncertainty of the antenna's capacitance, strays, and component tolerances and the receiver's antenna input impedance suggests that the negative capacity be variable. The negative capacity can be varied by changing either C_f or the amplifier's gain. Because variable capacitors are relatively difficult to obtain, C_f is selected to be fixed and the gain is varied by changing R_c. **Equation 2** shows that when R_c is composed of a 250 Ω variable plus 82 Ω fixed, the amplifier gain can be varied from 2 to 6 and the generated negative capacity varied from 15 pF to 75 pF. The power dissipation in R_c is less than a milliwatt, so any variable carbon or cermet pot can be used. A wirewound variable resistor should not be used, because its inductance increases the collector impedance with frequency and causes the negative capacity generated to change with frequency.

While the maximum available power is obtained with a matched load, the maximum voltage is developed across an open circuit. The active antenna's negative capacity generator presents an open circuit to the antenna's terminals. The negative capacity cancels the antenna's capacity—it resonates the antenna's capacitance. The gate of Q1 looks like an extremely large resistor. The DC gate return resistance R_g can be hundreds of megohms because the gate current of the 2N5457 is a fraction of a nanoamp. The leakage across the circuit board or a pencil track on the circuit board can provide the high resistance R_g.

The negative capacity generator can be built on perfboard mounted in something like a minibox. The whip radiator should be connected directly to the gate of Q1. Even a short piece of transmission line between the whip and the negative capacity generator

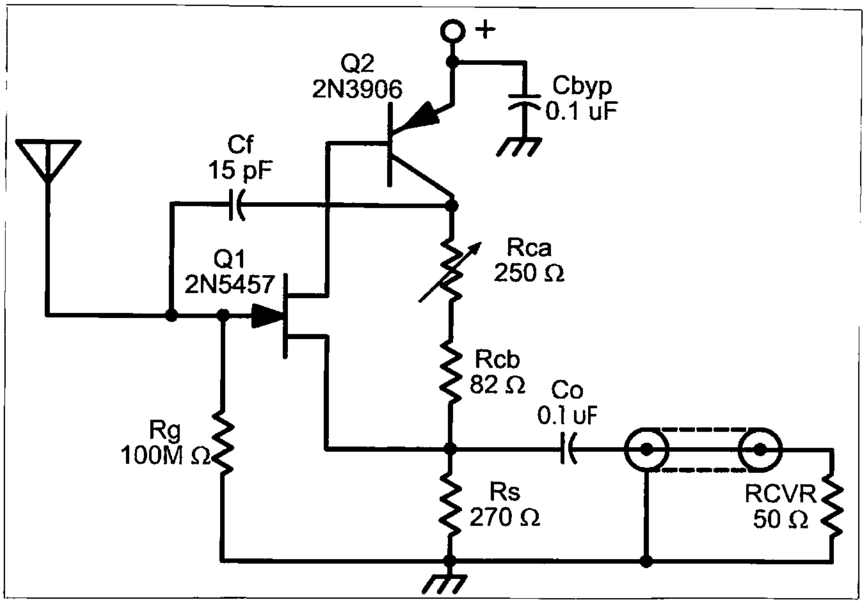


Fig. 3. A negative capacity can provide a conjugate match for a short antenna.

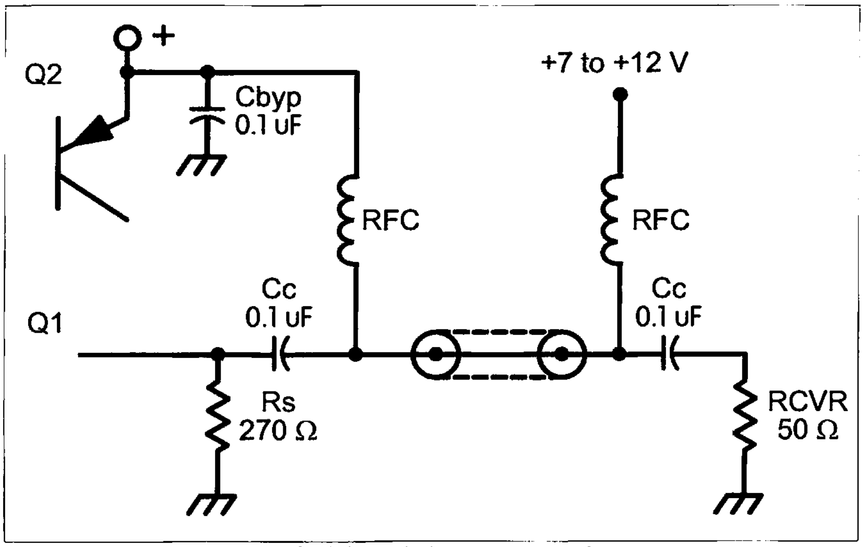


Fig. 4. DC power can be supplied through the transmission line.

just adds capacity that must be canceled and should be avoided. A banana jack makes a good entry connector for the whip. It probably goes without saying, but if the active antenna is to be located outside it should be sealed against the weather.

The power supply for the negative capacitor generator is not critical—anything from 7 V to 24 V will do. The current drawn is about 10 mA, so the life of a battery would not be particularly long. But 10 mA can probably be stolen from the receiver without ill effects. **Fig. 4** shows how DC from the receiver or other remote source can be fed to the active antenna through the transmission line. The separation between the antenna and the receiver can be virtually any distance. The RF chokes in **Fig. 4** can be any inductance that has a reactance of more than 500 Ω at the lowest frequency of interest. The inductance L can be found with the following equation:

$$L = 500/2\pi f = 250/\pi f$$

where L is in henrys
and f is the lowest frequency of operation in Hertz.

If the supply voltage is high enough, the RF chokes can be replaced with resistors. (The voltage drop across the two 470 Ω resistors will be about 9.4 V.) Since the voltage at the emitter of Q2 should be at least 7 V, the supply voltage should be greater than 9.4 V + 7 V = 16.4 V when resistors are used.

The adjustment of R_c is straightforward and only needs to be changed when the antenna is moved or changed: Start with R_c set at minimum, tune the receiver to a convenient frequency someplace in the 80 or 40 meter bands, and adjust R_c for the greatest output. The receiver doesn't need to be tuned to a station, because the man-made noise intercepted by the antenna will surely override the receiver's internal noise. If the receiver has an S-meter or other tuning indicator, this can be used to indicate the maximum signal strength. Of course, it can also be done just by listening.

The receiver's input resistance has been assumed to be 50 Ω, but it may vary with frequency. If this is the case, the negative capacity will change with tuning. When the gain is excessive, the total capacity at the gate of Q1 will be negative and the circuit will oscillate at the frequency where the antenna is a half-wave long. If the receiver's input varies with frequency, adjust R_c for optimum at the frequency that has the highest receiver input resistance. The match will not be perfect at other frequencies but that's the trade-off between peak performance and adjustment-free performance.

The improvement over just a short antenna connected to the receiver is amazing. When the antenna impedance is 1500 ohms, the voltage applied to a 50-ohm receiver suffers a 30:1 loss (29.5 dB). And this loss is to a signal that is already small: A six-foot whip has an open circuit output that is about 1/6 (15.5 dB) the output of a quarter-wave vertical just by virtue of the different lengths. These two losses stack up to a 45 dB penalty imposed by an unmatched six-foot vertical. At lower frequencies, it is even worse. Is it any wonder why short antennas are the very last choice?

With the active antenna described here, a six-foot whip does a reasonable job in the shortwave bands. Not as good a one as a full-sized quarter-wave vertical, but then again, it can fit on the wall and probably cost under $10—and you certainly can't say *that* for a full-sized vertical.

Upgrading the 209

Add this simple resistance meter to your MFJ antenna analyzer.

Mike Walker KG5CM
11102 Sharpview
Houston TX 77072

Once I used a borrowed MFJ-259 antenna analyzer, I knew I had to have one. It was a terrific little unit that did everything advertised. For hams not familiar with it, the 259 is a signal generator with a frequency counter and a return loss bridge all in one box. You can tune antennas and tuners, adjust tuning stubs, use it as a grid-dip meter (with optional coils), and do other wondrous things as well. It even tells the impedance of a circuit, which is handy. If the SWR meter reads 2:1 SWR, you can see whether the impedance is 25 or 100 ohms.

One minor problem turned up while N5YTN and I were adjusting his six- and two-meter beams: the last three digits of the frequency counter kept bouncing around. It was more an annoyance than a real problem, but it was distracting.

K.I.S.S.

My ham budget is meager, so I started saving up for my own 259. It seemed like every time I got close to the $239 required for the analyzer, something trivial would come up. I don't like to walk to work, so I bought tires, a water pump, etc. You know the drill.

The whole time this was going on, I was thinking about the pocket-sized frequency counter I already owned. It's the Radio Shack™ 22-305, which reads to 1.3 gigs.

Now I became the frugal ham. The MFJ-209, with a jack on it for an external frequency counter, is around $100. I could get a 209, and all it would lack is the resistance meter. I read in the MFJ literature that the 209 and 259 units are identical—there are just fewer "bells and whistles" on the lower-priced unit. In less than four days, I had a shiny new MFJ-209.

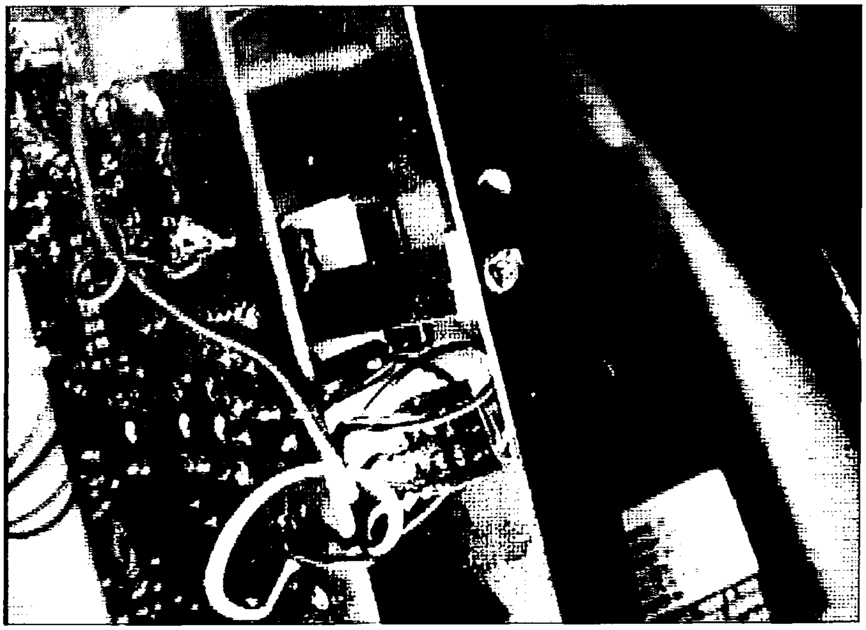


***Photo A.** Side view of analyzer showing trimpot and momentary switch. Photos by Otto Barsch.*

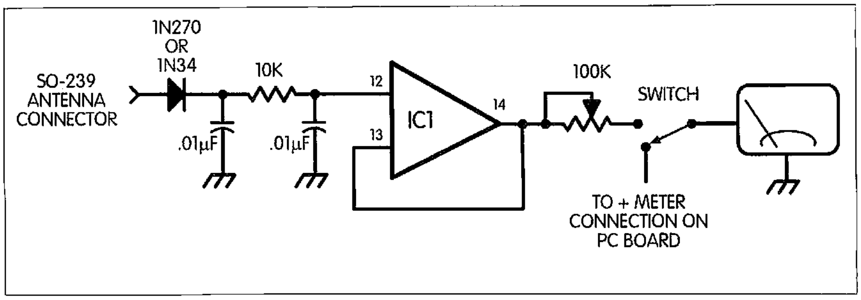


Fig. 1. Basic resistance meter circuit.

Qty.	Part
2	.01 µF 50 VDC capacitor
1	1N270 or 1N34 Germanium diode
1	10 kΩ 1/4 W or 1/2 W resistor
1	100 kΩ 1/4 W trimmer potentiometer
1	SPDT momentary contact push-button switch

***Table 1.** Parts list.*

The 209 worked like its big brother, at less than half the price. The best part was that the frequency readout on the Radio Shack counter was solid as a rock. Just dial up a frequency, and boom! You know you're there.

Now I decided I needed a resistance meter. I thought about adding a bar graph display, because there simply was not enough room to mount another meter on the case. After a few days of contemplating one method and another, I decided simple is best. Just like already owning a frequency counter. Well, the 209 already had a meter built in.

By adding an SPDT momentary-contact switch, the meter could serve a dual purpose. I recommend using a momentary-contact switch because I could just see myself whacking at a dipole until the SWR meter read as low as possible, then finding I had the unit in the *resistance mode!* You can bet a few new words might be inspired by that error.

Construction

The modification is simple. All it takes is the switch, a germanium diode, a trimmer potentiometer, two capacitors, and a resistor. The whole job takes about an hour.

Remove the back of the MFJ-209. Connect the anode of a 1N34 or 1N270 diode to the center pin on the antenna connector. Make the lead short, 1/8-inch or so, since the device can be used at VHF frequencies. With the base of the unit towards you and antenna connector away from you, the diode should lead off to the lower right from the SO-239 center pin.

Scratch the paint off the ground plane of the PC board, in a square area about 1/4-inch on a side, directly beneath the cathode lead of the diode. Solder one side of a .01 µF cap to the ground plane. Make the ground lead as short as possible. Mount the cap vertically and attach the other leg of the cap to the cathode of the diode, again with short leads.

Now attach a 10 kΩ, 1/4-watt resistor to the cap/cathode connection and solder. This is dead-bug-type construction and it works well here. Now scratch the paint off the ground plane under the end of the resistor that is floating in the air. Add another .01 µF cap from the resistor to ground. You have just completed the detector portion of the resistance metering circuit!

The signal from the detector must be buffered to operate the meter. Fortunately, there is one unused section on the quad op-amp used in this unit.

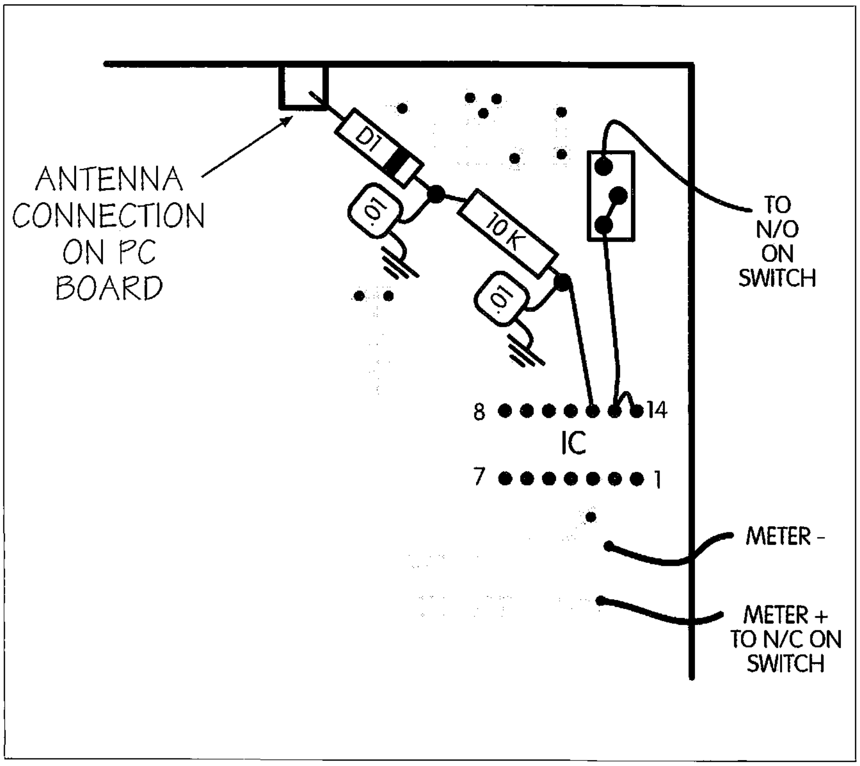


Fig. 2. Board connections.

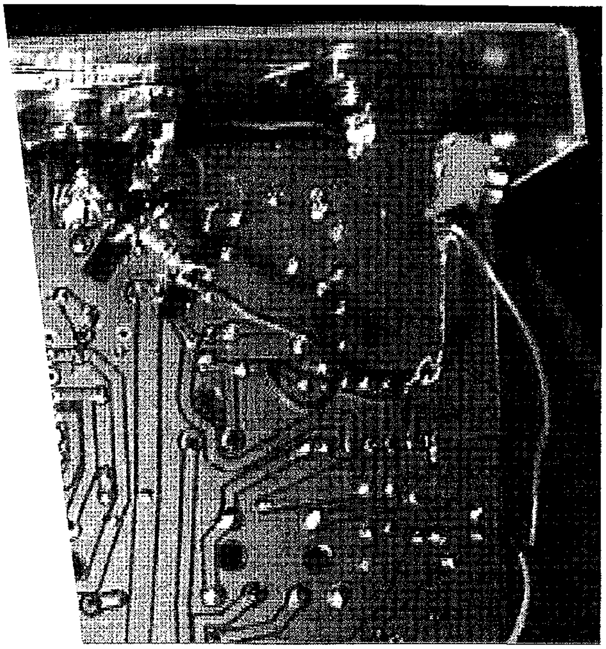
The pins of the
foil pads around
solder directly to
I use a 55-watt ı
tip. This iron is qu
get on and off a c
At the very least, .
tip—that will help
solder connection
plane in the detecto
If your resistor
enough, you can att
pin 12 on the IC. (
small insulated wire
wrap type, to make
from the resistor/cap ı
IC. Solder a similar
tween pins 13 and 14.
the amplifier modificat
I mounted the SPDT
contact, push-button swi
left of the SWR meter. I
and watch those chips.
switch. I disconnected
lead of the meter from tl
and attached it to the con
the switch.
On my unit, the red wi
meter is grounded and a g
the positive lead. Connect
wire from the normally-clo
the switch to the pad the r
had been soldered to.
The normally-open conta
switch may be used to sup
calibration potentiometer.
one end of the trimpot to ı
mally-open pin on the swit
the wiper and other end of the trimpot together with a jumper wire, and solder the other end of the jumper to pin 13 or 14 on the IC. These are the pins shorted together in a previous step.

If your trimpot or switch is too large to allow mounting the pot between the PC board and the front of the chassis, you can mount the pot directly to the jumper shorting pins 13 and 14 on the IC. Use a 1/2-watt resistor lead or similar-size wire to support the pot and short the pins on the IC.

Now we are ready to calibrate the resistance scale. You need a selection of resistors or a trimpot connected to the SO-239 on the analyzer. I set the

Please fill out this multi-purpose card when you want to plece a Subscriptiou to 73, renew your Subscription 73, order FREE Reader Service information, and/or tell us what you think of this issue by filling out the Feedbeck part of the cerd.

Our entire staff thanks you...your card will be entered in our monthly drawing when you include Feedback information about this issue.



owing connections to IC.

ith a
set-
bout
and
ght.
2:1
25
VR
ou

can calibrate the meter face if you want. A low and high indication is all I aimed for.

That's it! You now have a full-featured piece of gear for your shack. You saved $139. And instead of a 170 MHz frequency counter, you have a 1.2 gig one! Enjoy the project, and happy DX ...

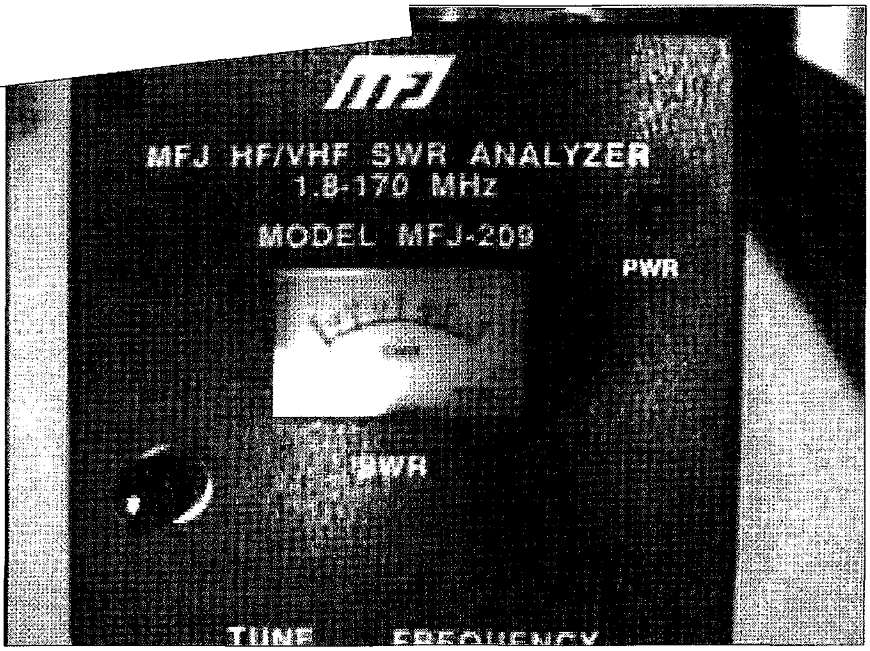


***Photo C.** The momentary push-button is mounted just to the left of the meter face.*

Five-Band Magnetic Loop Antenna

Build a loop for QRP, and tune it up just right!

Francis Y. Kelson K2KSY/HL9BK
PSC 450, Box 0826
APO AP 96206-0826

The magnetic loop has been used successfully worldwide for many years, but one of the problems faced by builders today is the acquisition of suitable variable capacitors. Having tried ARCO trimmer caps which overheated on the higher frequencies, I decided to use coaxial cable, since it has the inherent capacity and voltage protection needed for a 5 W-plus QRP signal. All coaxial cable has a specific capacitance per foot value, so it's a simple matter to calculate the length needed for a given capacitance. Also, its light weight maintains the loop's integrity.

With propagation conditions getting better by the day, this little device should lend itself quite well to the QRP purist, or to the person who just wants to SWL or listen to his favorite net. Supplemented with a long wire antenna for the 3.5, 7.0 MHz bands, its noise-canceling ability should make for a good copy.

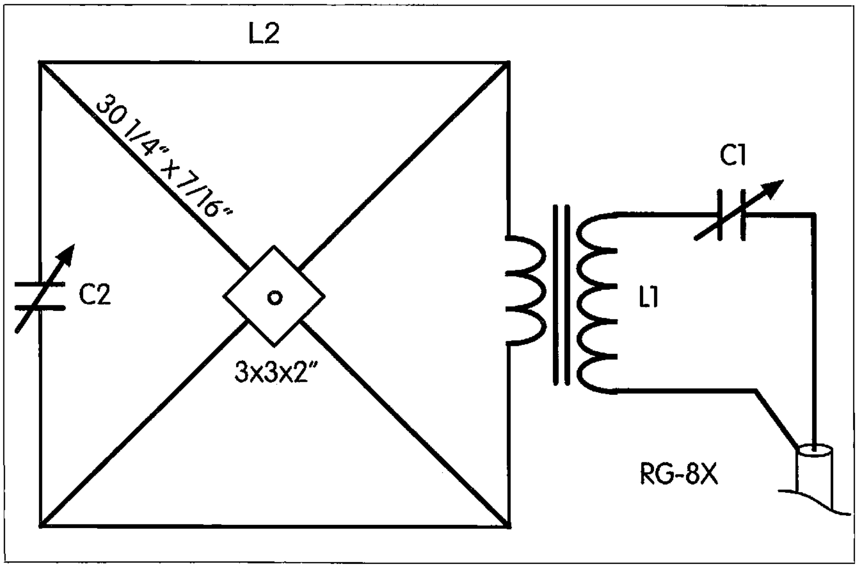


Fig. 1. Schematic diagram of the Five-Band Magnetic Loop Antenna.

Construction

The loop consists of three parts. Printed circuit board 1 (PCB1) tunes the loop to the coaxial input. PCB2 mounts the desired capacitance on the other side of the loop. The loop itself (L2) is supported on a framework of crossed dowels.

Cut four 7/16-inch dowels to 31.5 inches each, and make a 1/16-inch slot in one end of each dowel. Shellac the dowels and set them aside to dry.

You'll need a block of wood for the hub, three inches square and two inches thick. Drill a 7/16-inch-diameter hole into the middle of each side of the block, to a depth of 1-1/4 inches. I also drilled a 1/4-inch hole through the center of the block for mounting. Shellac the block and set it aside to dry.

When the unslotted ends of the dowels are inserted into the hub, they should measure 30-1/4 inches from the hub's outer edge to the dowel tips.

Cut two segments of #22 audio wire, each 7 feet, 4-1/4 inches long. Strip 1/8 inch of insulation from each of the wires' four ends; tin each end with solder. Solder a Caltern™ ring terminal, common to auto wiring (the #22-18 Red are suitable), to each end of the wires.

Prepare two single-clad PCBs as depicted in **Figs. 2** and **3**. You may use something else, just as long as you keep the separation for L2 the same as shown, or else you may have trouble keeping L2 taut with the dimensions shown.

The coaxial input is L1, toroid T 68-7 White, wound with #24 enamel wire 25 turns, spaced approximately one millimeter apart. The secondary winding is prepared by winding the #24 enamel wire for a total of six turns, encompassing at least three-quarters of the toroid's primary. This will approximate a 75-ohm input, which is easily matched up with the RG-8X coax.

Remove the insulation from the toroids' four leads, and solder to PCB 1 (**Fig. 2**). Solder C1 across the copper traces on PCB1 as shown.

At this time you may want to apply coil dope or clear fingernail polish to coil L1.

Note that the negative PCB trace continues along a path beneath C1, so don't mount C1 flush against the PCB.

Mount the ring terminals of the audio wire to PCB1 and PCB2, using 6-32 x 1" screws, nuts, and washers. Use three nuts on each PCB, so that removal of L2 will be easy later on.

Insert the dowels into the hub, and align the wire on the dowels as shown in **Fig 1**.

You may remark on the fact that, worked out by the formula for determining cross-arm lengths, one quarter of L/7071 = 63.50 inches, but ours is 64 inches. This gives us a slight bow to the loop for rigidity—and it also looks nicer that way.

To build the various capacitors, you will need approximately five feet of RG-174U mini coaxial cable, plus a little extra to play with. Cut all coax as specified by the chart for your frequency of choice.

On each piece of coax, measure off one inch, and remove the outer insulation. Bend the coax at the point where

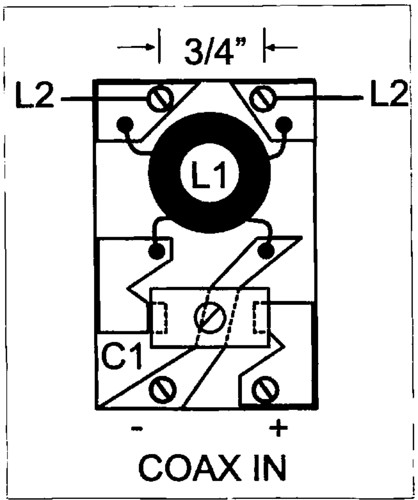


Fig. 2. PCB1 (approximately 2-1/4" x 1-1/2") provides mounting for the input circuit.

the outer insulation now meets the braid. With a sharp-pointed instrument, push aside the braid until the center conductor is exposed; extract it from the braid, leaving two terminal leads each one inch in length. Tin each tip lead, and solder on a ring terminal.

According to **Table 1**, measure off the specified length, from the junction of the braid and center conductor to the coax tip. Hold it!

Despite what the chart specifies, add one inch to each coax. You will use this extra length to compensate for the area density (capacitive effect) in which you will place your loop for operation. I tuned mine in the shack. When I moved it out to the patio there was no change, but this will vary depending on your own surroundings. A 500 pF trimmer was used for the 3.5 MHz band, since the length of coax needed would have been quite long enough. However, this limits the power on this band to only a couple of watts.

If you elect to use the trimmer capacitors for all bands and are going to use two watts or less, just drop me an SASE if you're unsure of values and tuning, and I will be glad to explain it.

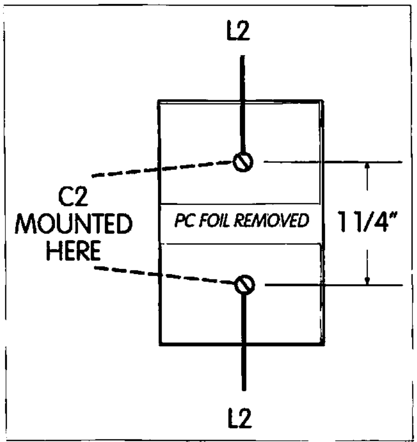


Fig. 3. PCB2 (approximately 2-1/4" x 1-3/4") connects the various capacitors to loop L2.

Tuning the loop

Connect your RG-8X mini coax to the loop's input as in **Fig 2**. You can use just about any length—I've used 16 to 50 feet in various situations. Connect the free end of this coax to an MFJ-249 SWR Analyzer. At this point you should have the capacitor of choice mounted securely to PCB2.

Search the analyzer for a frequency that obtains a dip. With the added one inch of coax, your frequency should be somewhat lower than expected. Then adjust C1 for the best dip possible. C1 will pull the loop's resonance point a little higher in frequency, so adjust the analyzer a little higher in frequency, and you will note that the SWR is getting lower.

Start to trim your RG-174 coax, about 1/8 of an inch at a time, until you are very close to the frequency selected, and repeat the procedure:

1. Check frequency for a dip.
2. Adjust C1 for a dip.
3. Check frequency again.
4. Trim coax, recheck frequency.

Repeat steps 1 through 4.

Once all your coax caps are resonant, simply roll the larger lengths of coax over two fingers and secure with a rubber band or tie-wrap. The 18 and 21 MHz capacitors are short enough to just hang freely.

Once C1 is optimized, for purity an antenna coupler can be used despite C1 being in series. Since the loop's bandwidth is about 50 kHz, the antenna coupler will allow wider frequency variations.

Desired Frequency	Length of Coaxial Cable
7.0 MHz	26-1/8 inches
14.0 MHz	5-3/4 inches
18 MHz	3-1/8 inches
21 MHz	1-5/8 inches
3.5 MHz	1 each Arco trimmer 500 pF

***Table 1.** RG-174U chart.*

A wattmeter or SWR meter placed at the input of the loop should reveal a flat SWR when full power is applied. If it doesn't, retune the coupler and retouch CI. Proper tuning is the key to success when using an antenna of this type. Use of a field-strength meter or neon lamp is a great help, too.

Qty.	Description
4	7/16" dowels, each at least 31.5 inches long
1	Wooden block for hub, 3 x 3 x 2 inches wide
15	Feet #22 insulated audio wire
5	Feet RG-174U mini coaxial cable
1	PC board, single sided, 3 x 5 inches
12	Caltern ring terminals, Red #22-18
1	Toroid, T 67-7 White
5	Feet #24 enamel wire
1	trimmer var. cap 500 (from Marvac, San Diego, CA)
6	6-32 x 1 inch screws
16	6-32 nuts, plus 12 #6 lockwashers

***Table 2.** Parts list.*

For operation outdoors, a couple of plastic pill bottles can be slipped over PCBs 1 and 2.

Seal the coax caps with Shoe Goop™, or cement, at their tips and terminal junctions.

If you cannot beg, borrow, or acquire an MFJ-249 SWR Analyzer, you could use a grid dip meter to acquire resonance, and with the application of very little RF power, obtain a roughly suitable SWR.

I have accomplished QRP DXCC, WAC QRP, and 1,000 miles per watt with Argentina using one watt of power. I also have 40 states confirmed, using mostly wire and loop antennas. 73

Electronic Construction from A to Z, Part 3

Everything you wanted to know about building stuff but were afraid to ask.

Marshall G. Emm N1FN/VK5FN
2460 S. Moline Way
Aurora CO 80014
[n1fn@mtechnologies.com]

If you've been following along with this series of articles, you will have a brand-new, working, VM-110 AC voltage monitor (see end of text for purchasing information), ready to install in some sort of enclosure. That's what we're going to talk about this month—installing projects in enclosures and finishing up the project so that you will have a useful, attractive device that you built yourself!

When you have built a few projects it might suddenly dawn on you that the "fun part," the electronic work of soldering components onto circuit boards and getting things to work, is usually *less than half of the job!* Getting the project installed neatly in a box, with labeling or panel marking that doesn't look like it was done in kindergarten, is a lot of work. It involves different skills, and different tools, and is always going to be time-consuming. But it's worth it, as we shall see when we finish the job.

The first problem is to find an appropriate enclosure, or, as we say in the trade, a box. Aside from the obvious considerations of size and shape, you should also think about whether the box should be plastic, or metal, or plastic with a metal panel.

Paper or plastic?

Oops! Wrong question. *Metal* or plastic? Your choice will depend on the nature of the project and what you have in the way of tools—plastic is, of course, much easier to work with. But if you are working with an RF circuit or one which will be used in an RF environment, you will want to use a metal box because of the intrinsic shielding effect. Another factor is whether the enclosure must, should, or could be used as a common ground for the circuitry it is to contain. Some controls need to be completely isolated from ground (e.g. the air-variable capacitors in many antenna tuners) and a plastic box makes this a lot easier. One last consideration in this regard is whether the circuit board will need to be physically attached to the inside of the enclosure, in which case clearance of components and solder tracks from the enclosure is a factor if the enclosure is conductive.

Size and shape are fairly obvious parameters, but it is generally a good idea to get a box that is one size larger than the minimum size to contain the project. You may also want to think about how you will use the device when it is finished. If it is an "active" device, such as a keyer, you may want to put it in a box that is much larger than actually required so that (a) it will stay in one place on your desk, and (b) you can find the controls without looking.

A good place to start is to "pre-visualize" your completed project. Famous photographer Ansel Adams is credited with inventing the term to describe the process he used in creating a photograph. Try to picture what the device will look like when it is complete, and how it will be used. Some controls, indicators, connectors, etc., need to be immediately accessible (e.g., on the top or front of the box), while others can be located on the back or sides. In some cases you may want to drill "access holes" for board-mounted trimmers. And don't forget the wires! If there will be wires entering the box rather than connected via jacks, then there will have to be holes for them, usually on the side of the box closest to where the wire goes when the unit is in operation.

You should also devote some thought to how the device will be mounted in the box. If it is something like a QRP transceiver that is likely to

need adjustment or alignment or modification from time to time, then you want to make it fairly easy to open it up. A normal box has six surfaces (four sides plus top and bottom) that you can attach things to—if you use more than two of them you will have a real Chinese box puzzle to take apart! If there are board-mounted controls to which you will need occasional access, then be sure to use enough wire when you connect the board to the panel that you can remove the panel and have room to work without having to disconnect wires.

Yet another tool kit

Fortunately, if you have the basic electronic tools described in Part 1 of this series, you have most of what you need to work with enclosures. The most important additional tool is an electric drill (or drill press) and a set of good drill bits in various sizes. If you are going to do a lot of building, you might want to think about an inexpensive drill press. Sears™ has one for around the $100 mark. It has other uses around the shop and home, and there is really no substitute when it comes to doing precise drilling. The drill bits themselves usually come in sets with graduated sizes. You have your choice of SAE, metric, or "numbered" series, but I'd suggest going for a good set with 1/32" increments, which will allow you to match just about any required size. A set up to a maximum diameter of 3/8" will cover most requirements, but you might also want to purchase individual bits for 7/16" and 1/2". The larger bits are often available with a 1/4" or 3/8" reduced shaft.

The drill and bits are all you need for the VM-110 project, but here's a list of tools to round out your collection:

Center punch, for marking the location of holes to be drilled and scribing lines on metal.

Hacksaw, for cutting the ends off the shafts of pots and rotary switches.

Hacksaw *blade*, for use by hand.

Calipers, for measuring drill bits, shaft diameters, and hole diameters.

Files—flat, round, and half round.

Sheet metal nibbling tool, for making odd-shaped holes.

Crescent (adjustable) wrench, small, for tightening nuts on pots and switches.

Oh ... some builders recommend a heavy (2–3 lb.) hammer and an anvil, because if your kit doesn't work it is much more rewarding to smash it on an anvil than to simply throw it at the wall. You won't need them though, because your projects *will* work. And if they don't—we're going to talk about troubleshooting next month.

A box for the VM-110

Having due regard for all of the considerations mentioned above, I chose the Radio Shack™ #270-230 for the VM-110 project. It's a plastic box with a thin aluminum panel. There is enough room in the box to work comfortably, and also for a second unit if we decide to add the VM-12 DC voltage monitor later.

To install the VM-110 in the enclosure, it is necessary to drill holes only for the LEDs, and make some provision for the power cord (from the wall transformer). The circuit board will be mounted to the metal panel simply by gluing the LEDs in place.

While you could drill a hole near the bottom of the box for the cord (and that is something you will often want to do with more elaborate projects), in this case it is very easy to cut a small notch in the top edge of the box (at the right end as you are looking down on it). That way you can remove the thing from the box without disconnecting the power cord if you need to later. **Fig. 1** shows the details of the notch.

To make the notch, make the two vertical cuts with your cutters or hacksaw blade, then bend the tab back and forth with a pair of ordinary pliers until it breaks off.

DO NOT use this approach with a metal enclosure, though—the power cord will need to be insulated from the enclosure with a grommet, and a round hole is a lot easier to work with.

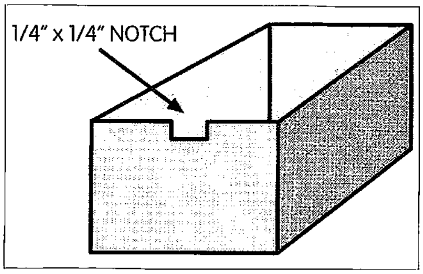


Fig. 1. *Cut a notch in the end of the box for the power cord.*

Laying out the panel

Once you've chosen your enclosure, the next step is to lay out the panel and do any necessary drilling and fitting.

Laying out the panel is simply a matter of marking the locations of holes for the hardware that is to be mounted on it. It seems as if I am always telling you that there are two ways (or more) to do something. Guess what? There are two practical ways to lay out your panel. The first is to physically measure everything and make appropriate marks directly on the panel. The second is to use a template, or a paper representation of the panel that can be attached to the panel and drilled through. The VM-110 is such a simple project that you can easily do it "by hand," but I've provided a template which can be used (**Fig. 2**) if you are using the specified Radio Shack™ box.

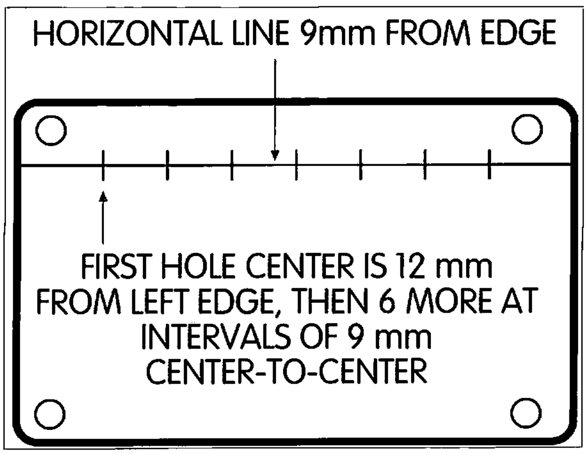


Fig. 2. *Panel drilling template for the RS #270-230 box. Hole diameter is 11/64- or 7/32-inch.*

There are four steps to laying out the panel by hand:

1. Define the job. In this case, determine that you need seven holes in a straight line.

2. Do the measurements and arithmetic. A short (six-inch) flat steel rule (obtainable from most hobby shops and business supply houses) is perfect for this. If you must use a tape measure, use an old carpenter's trick and measure from the one-inch line rather than from the hook on the end of the thing—just remember to subtract the inch from absolute measurements! It helps greatly if you are familiar with the metric system and have a metric rule, because the arithmetic is so much simpler. For example, let's say you have seven holes, 11/32-inch apart. How far is it between the two end holes, and how far is the first hole from the left edge of the panel? You'll find it's much easier to use 9 mm instead of 11/32-inch. You will also note that the actual specifications of many components are metric. Getting down to specifics now, when you measure the LEDs on the VM-110 you will find that they are generally 9 mm apart (measuring from the center of one to the center of the next). The leads are slightly flexible, but if you hold the ruler firmly against them you will see that they can all be centered at 9 mm. So what we have learned so far is that we are going to need to lay out seven holes in a straight line, with 9 mm between the centers. The length of the line will be the total sum of the distances between the holes, or the spacing times the number of holes minus one. In this case, the line from the center of hole #1 to the center of hole #7 will be 54 mm long (9 mm x 6). The width of the panel is 78 mm, so to center the line you would find the "unused" width, namely 78 - 54 = 24 mm and divide by two to give you the empty space on each side of the line—12 mm. Or, to put it another way, the first hole will be 12 mm from the left side of the panel. Double-check everything, and make sure that the installed components will still fit inside the box if mounted in these positions.

3. Mark the panel. You mark it with a pencil or a pen (depending on what the surface is like) or scratch your marks using an awl or a center punch. For the VM-110 we need to mark the positions for seven LED holes on the panel. Start with a straight line across the width of the panel, 9 mm from the top edge. Mark a spot 9 mm down from the edge at the left side of the panel, then another spot 9 mm down from the edge at the right side, then use a straightedge to draw a line between the two marks, across the panel at a consistent 9 mm from the top. Measure 12 mm along that line from the left edge of the panel and mark the position for the first hole. Measure and mark the other six holes at 9 mm intervals (again, metric makes it easy because you can just add nine to the last position mentally and read it straight off the ruler). You should now have seven marks, and the rightmost one should be 12 mm from the right edge of the panel.

4. Check it all again. Seriously, you haven't done anything yet that can't easily be undone. Go one step further and you risk ruining the panel if you made a mistake! Or as my carpenter father-in-law always says, "measure twice, cut once."

If you have a drilling template for the panel (**Fig. 2**), you can avoid all the hassle of measuring and calculating—just attach it to the panel with rubber cement or cellophane tape.

Punching and drilling

By punching, I mean center-punching the hole locations, not using a punch to create the hole! Whether you hold it in your hand or are fortunate enough to own a drill press, any drill will have a tendency to wander if you don't center-punch the material before you drill. A center punch is the correct tool for the job, but you can use an awl or a nail if need be. Place the panel on a block of wood or other hard surface, and carefully place the tip of the punch on the mark for the center of each hole. Tap the end of the punch *gently* with a hammer or mallet so that the punch leaves a tiny dent in the metal. If you are working with plastic (and sometimes

with aluminum), you can get an adequate dent just by pressing firmly on the punch rather than hitting it with a hammer.

Drilling can be tricky, and despite the ready availability of power equipment and high-speed twist drills it is worth going over the basics. As with most tools, you develop skill as you go and if you are experienced at drilling holes in things you will have no trouble with this sort of work. On the other hand, if you have never used a drill before, you will find it is tricky at first—but it gets easier with practice.

Start small! Drill each location with the smallest drill bit you have (often 1/16-inch) and gradually re-drill each hole using bits about 1/8-inch larger until you get to the required size.

Use a backing block! Clamp the panel firmly to a block of wood and drill through the panel into the wood. This will reduce (if not eliminate) burring on the bottom side of the panel, and reduce the likelihood of the panel slipping. You will be tempted sometimes to hold the material by hand, but you will learn over time when it is safe to do that and when it is likely you will end up with a sprained or broken finger, or worse. Eye protection is also a must.

For our VM-110, you can probably drill the pilot hole and then go straight to the 7/32-inch final size. The actual size of the hole (or diameter of the LED) is probably some neat metric size, but most of us don't have metric drills. The closest I could measure was 11/64ths, but if your drill sizes are in 32nds you'll have to use 7/32. A quarter-inch drill will work too, but it is not as neat a fit.

Once the holes are drilled, you will need to remove the burring on the bottom side of the panel. You can do this with a file, a rosette countersinking bit, or even your hobby knife as long as you are working with aluminum or plastic. Another technique is to use just the tip of a slightly larger drill bit (which is what you will probably have to do with a steel panel).

Check it all again. In this case, if you made a terrible mistake of some kind you can start over and re-drill the holes on the other side of the panel—the suggested panel label will cover the

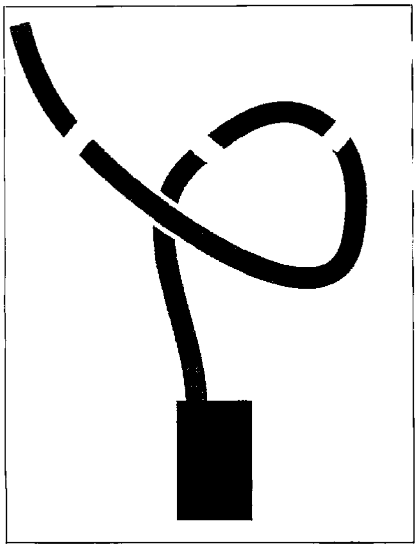


Fig. 3. The "Electrician's" or "Underwriter's" knot.

unused holes, or you can cover them with a piece of masking tape if you are labeling your panel that way.

Hole too small?

That's not going to be a problem with this project, but since it is such a common problem I'll give you a couple of pointers. The techniques vary quite a bit depending on the material you are working with as well as the size and shape of the hole and, of course, the tools available to you.

Let's say you need to mount an SO-239 coax connector, which has a hole about 5/8-inch in diameter, and the largest drill bit you have is 3/8-inch. The "correct" solution is a chassis punch, but who can afford those?

So you'll have to make do. Drill the hole to 3/8-inch and then use a pencil or scribe to trace around the connector so you can see how large the finished hole must be. Then use one of the following techniques to enlarge it.

Bad—a flat or triangular file.

Good—a round file. A good choice is one of the round files used for sharpening chainsaws, because they are readily available and relatively inexpensive. Just file the hole out to the line that you marked, checking the fit periodically.

Better—a half-round file. A half-round file (rounded on one side, flat on the other) is much easier to use with larger holes because the curve is more gentle and it is easier to control.

Alternative—a small grinding cylinder on a drill press or Moto-tool™. You can also use a small sanding drum if you are working with aluminum or plastic.

If the hole is much larger than the largest drill bit, then you might want to use a very small bit to make a series of holes around the area that needs to be removed. The less material you have to remove with the file or grinder, the better.

Holes with corners?

No problem. This seems to be a real challenge for a lot of builders, but producing a rectangular hole is just a matter of patience and the right technique.

If the hole is large enough, an inexpensive sheet metal nibbling tool will get the job done in no time. The nibbler takes a tiny, rectangular bite out of sheet metal and it's simply a matter of nibbling your way around the opening. Leave a bit of an edge, though, because the finish is not very smooth and you will want to dress the opening with a file.

Another option is to drill a line of very small holes around the opening, then use a hacksaw blade to cut between them, finally cleaning up the line with a file. Drill one larger hole at a comer of the opening so you will have a place to insert the hacksaw blade. You might want to wrap some duct tape around the end of the blade that you will be holding—otherwise it's pretty hard on your hands. For a fairly large opening you might even want to insert the blade through the hole and then reinstall the hacksaw frame. If you have a scroll saw or a saber saw you can get hacksaw blades for them, too.

Putting it all together

Now it's time to install the circuit board in the enclosure. Or is it? If you are going to use an adhesive label for the panel, you need to apply it to the panel *before* you install the board, so skip ahead to "Making it pretty" and come back to this section when you have your label finished.

The seven LEDs on the VM-110 should fit neatly into the seven holes you drilled in the panel. Hold the board straight (so that it is parallel to the panel) and secure the LEDs by applying a good all-purpose cement or hot glue on the *inside* of the panel. Use a liberal amount, because that's all that's going to hold it together. And that's it. Now guide the cord into the little notch you made, slap the lid on and screw it down.

It's a good idea to put a knot in the cord on the inside of the enclosure near the hole where it enters. Then if someone pulls on the cord or it gets caught on something, the knot will take the strain and prevent the connections to the circuit board from coming loose. For two-conductor cords such as used in the VM-110, a simple "electrician's knot" will suffice. Split the two conductors over a distance of about two inches from the end and tie the knot as shown. This is one of those cases where a picture is worth a thousand words (**Fig. 3**). Obviously the end of the cord must be free, i.e., not connected to the circuit board. If you'd rather not disconnect it, you can tie a simple overhand knot.

Making it pretty

Commercial kits often come with a box that has been silk-screen printed or which has a printed decal to show the manufacturer's logo and necessary control indications. But that is a hugely expensive process that is impossible to justify for run-of-the-mill kits, especially if you only need *one*.

We've come a long way in readily accessible labeling technology in recent years. I've built things on wooden "breadboards" and made pencil marks on the wood. I've used masking tape with pen and ink markings, and I've used indelible pencils to write directly on panels. And I confess I have a large number of "devices" with no markings at all! Then there are the Dymo™ labels—I remember when they were really cool (and expensive); now they are inexpensive, but they look pretty tacky.

An attractive, inexpensive, and reasonably simple approach is available now if you have a computer graphics

program and a good printer (say, 300 dpi resolution, whether dot matrix, ink jet, or laser). The computer program lets you design a very attractive label for your panel, and the printer will produce the label on self-adhesive material which you can easily apply to the panel. If your "working conditions" don't include an adequate computer, program, or printer, you may be able to use one at your local Kinko's™ or even a public library.

As usual, I'm going to give you the specifics of how I prepared the front panel artwork for the VM-110 project, but the principles can easily be adapted. I'll try to explore a number of options, but first I'll give you the summary on how I do most of my small project labels.

•Design the label using a computer graphics program.

•Print the label on whole-sheet label stock (Avery # 5265 or #8165). Sometimes you can also use a copy of the finished artwork, printed on plain paper, as a drilling template.

•Apply the label to the panel.

•Apply an over-coat of clear self-adhesive vinyl (e.g., book-cover material), available from most drug stores and stationers.

•Clear the material from the holes and mount the controls.

•Apart from protecting the label from fingerprints, the clear vinyl also protects the ink—I use an ink-jet printer and the black ink is not waterproof.

•An obvious option, which I have seen used to good effect, is to paint the panel, then apply a label printed on *transparent label stock.*

The computer program needs to be capable of drawing with a fairly high degree of accuracy in literal scale (that is, if it says it's an inch on the screen it should print out as an inch). I use WordPerfect™ Version 7, which incorporates a cut-down version of Corel Draw™ that is adequate for most purposes.

Most drawing programs have a quick means of drawing squares and rectangles, so I usually start by drawing an outline of the panel, just to provide visual reference points and measurements from edges (I delete the outline before printing). Use small circles or dots to indicate the position of holes for controls and mounting screws—these will help you line up the label when you apply it to the panel. Remember to leave clearance for knobs for pots and such! It's extremely frustrating to go to a lot of trouble to produce a panel label and then discover that when you put the knobs on the shafts, you've covered up your text.

Print the label on plain paper first, and hold it (and the panel) up to a strong light so you can see that everything lines up. Once you have it right, print it on the label stock. I usually print out two copies, just in case!

Indexing the label to the panel is not difficult. I usually hold the panel and label up to the light and use a pencil to mark the position of a couple of holes. Then on a cutting board I put the panel on the label, matching the pencil marks, and trim around the panel with a hobby knife. I repeat that process with the clear vinyl, then use the hobby knife to trim out the label material from the holes.

The first time I prepared a project label this way it seemed like an awful lot of work, but the results were certainly worth it. As time goes by it gets a lot easier.

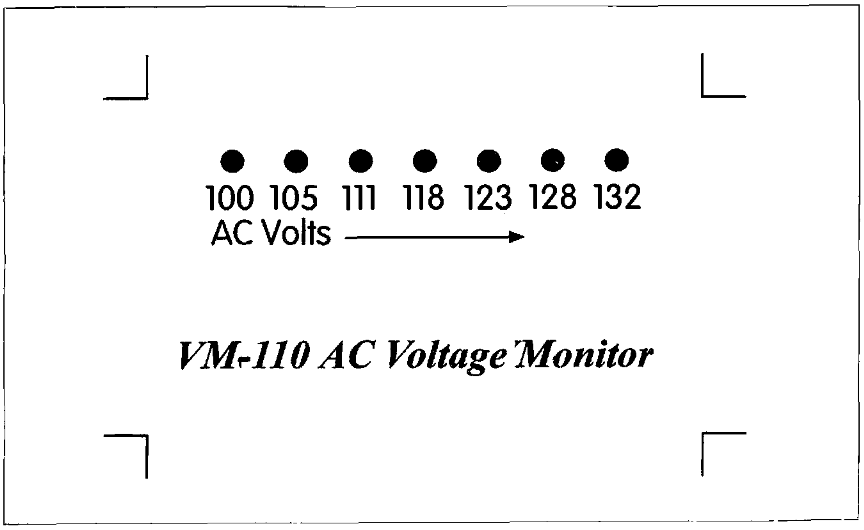


Fig. 4. Panel artwork for self-adhesive label.

But what if it doesn't work?

If you go outside late at night, most any night, and listen closely, you can faintly hear the pathetic sound of kit builders all over the world crying because they just can't get it to work. There are screams of rage, too, and crashes as non-functioning kits hit the wall or are reduced to atoms on the anvil. You can smile, though, because you are outside getting a breath of fresh air while you think about what to build next. We hope. But even in the best of families, things occasionally will go awry and Murphy is always lurking. If your project doesn't work, 97 times out of a hundred it will be because you did something wrong. One time in a hundred it will be due to a faulty component, and one time in a hundred it will be due to a mistake in the instructions. The hundredth time? We will never know.

Finding a problem cause can be time-consuming and frustrating, but it doesn't have to be. All you need is a plan, and we'll see if we can come up with one next month.

Rainbow Kit VM-110 ($10.95 + $5 s/h) is available from Milestone Technologies Inc., 3140 S. Peoria St. Unit K-156, Aurora CO 80014, or call (800) 238-8205 for credit card orders. Also available from Electronic Rainbow Inc., 6227 Coffman Rd., Indianapolis IN 46268, or call (317) 291-7262. 73

Mount Up!

Try this easy cell phone-to-2m antenna conversion.

Tom Smith WQ3A
2106 Mark Street
Bel Air MD 21015

Having read several articles on constructing mobile-mounted two-meter antennas, I set out to build one from ideas I got in *73* on how to convert an 11-meter (CB) antenna to two-meter use.

At a local radio store, I saw several low-cost CB antennas and was leaning toward the cheapest. I went through its disassembly instructions provided in *73*. The article was very well written and clear, but being the cheap, cheap, cheap antenna builder I am, I was still on the lookout for an even *cheaper* and easier antenna to convert.

In reviewing sales pamphlets and bulletins from several electronic surplus companies, I noticed a 900 MHz cellular magnetic mobile-mounted antenna. They were certainly in the right price range: $6 each. Furthermore, the catalog stated that this antenna element was easily unscrewed from its magnetic base.

Fine, I thought to myself: This feature might be just the thing to lend itself to the construction of a two-meter antenna. I counted the money I had left in my monthly allowance. Good news. I had saved enough for four antennas, including the shipping cost.

I immediately phoned in my order to All Electronics Corporation™. I found the salespeople there were very helpful and just plain nice to deal with. I waited with bated breath for delivery.

Finally, the magic knock on the door. Yes, it was the UPS™ man. He was very fast. By the time I reached the door, he had left my antennas and was halfway down the block! I picked up the antenna package and went straight to the basement workshop. Upon opening the packages, I was pleasantly surprised by a better-than-advertised antenna.

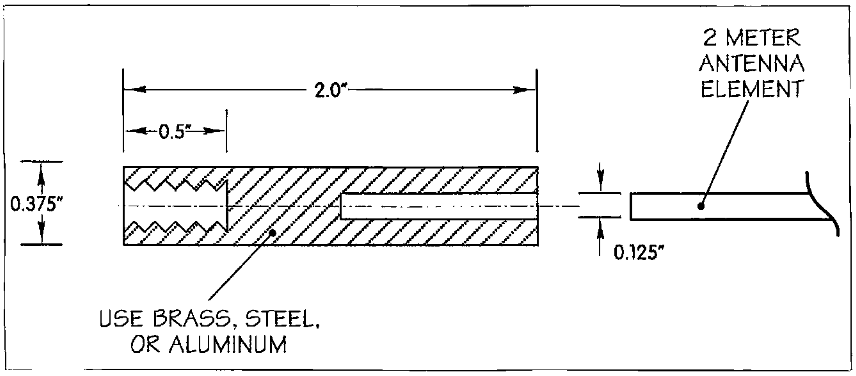


Fig. 1. Adapter assembly.

Construction

First, I unscrewed the 900 MHz antenna element from its magnetic base and laid it to one side. I checked the antenna mounting stud, a threaded stud whose size looked comfortingly familiar. To be sure, I got out the gauge and to my great relief it was, in fact, a 1/4-inch times 20 thread.

My next step was to check out the inside of the magnetic base itself. This task was very easy. I simply took a sharp knife and carefully cut the plastic cover from the bottom of the magnetic base.

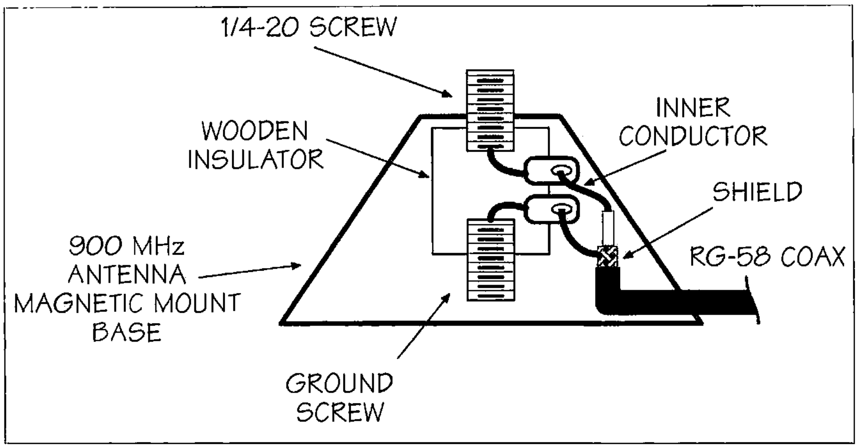


Fig. 2. Internal magnetic base connections.

(Please use care in performing this operation.) Once the cover is removed, use pliers or a wrench to remove the nut. Set the nut and magnet to one side. This completes the disassembly operation.

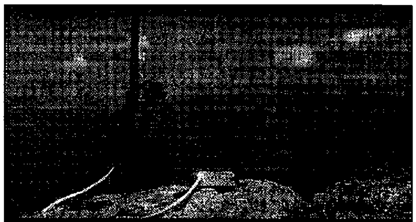
Start construction with the antenna adapter assembly (**Fig. 1**). Cut a two-inch piece of a 3/8-inch-diameter metal rod (this rod can be brass, aluminum, or steel). This piece will be the adapter assembly and screw onto the magnetic mounting base to hold the two-meter antenna element.

Using a #7 drill bit (0.2030), drill a half-inch-deep hole in one end of the adapter assembly. Thread this hole using a bottoming tap (size 1/4 inch x 20). Check out this drilling and tapping operation by screwing the two-meter adapter assembly onto the base of the 900 MHz antenna stud. Use a wrench to tighten the two-meter adapter assembly to a snug fit. Do not tighten the adapter assembly too much. This checks out the drill and tap operation for a good fit.

Unscrew the two-meter adapter assembly and lay it aside. Cut a 1/8-inch-diameter welding rod to a 20-inch length. Clean two inches of one end of the welding rod, using sandpaper. Keep cleaning until the two-inch length of the rod is bright and shiny.

Now, using a medium-wattage soldering iron and 60/40 solder, tin the clean end of the welding rod. Then solder a small ring of solder around the tinned area for a length of one and a half to two inches from the end of the rod. This tin-and-solder operation becomes a shim to ensure a tight fit in the opposite end of the two-meter adapter assembly.

To mount the two-meter antenna element to the adapter assembly, secure the two-meter adapter assembly in a vise. Tighten the vise around the adapter assembly firmly, but do not warp it. Insert the tinned-and-soldered end of the two-meter antenna element into the 1/8-inch hole of the opposite end of the adapter assembly (using the soldering iron). This completes the assembly of the two-meter antenna element and its



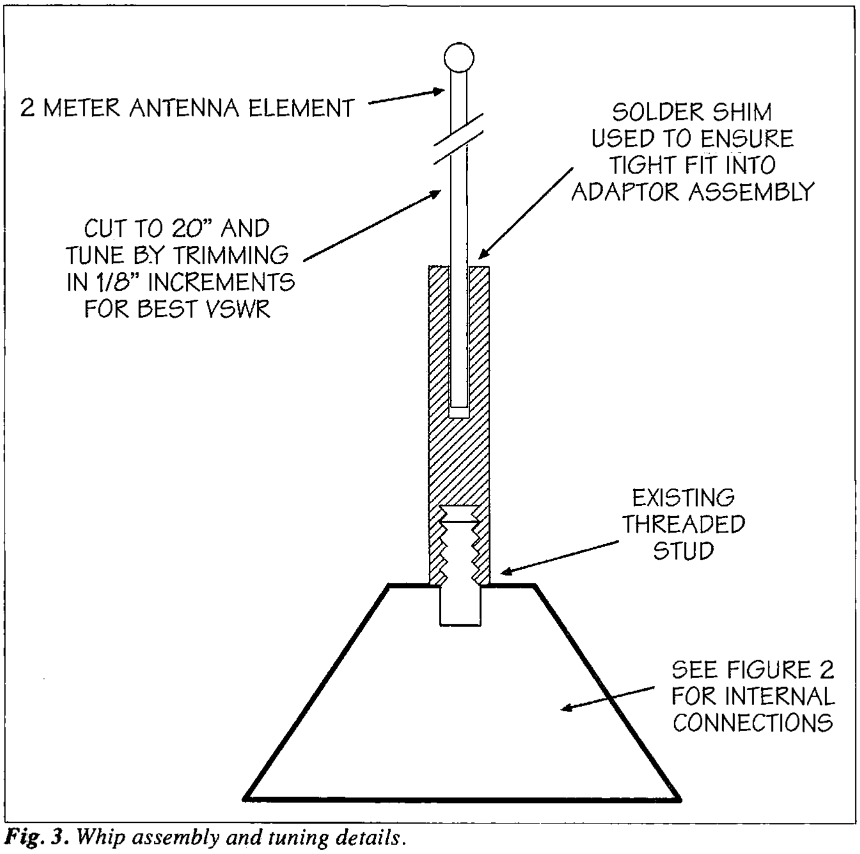


Fig. 3. Whip assembly and tuning details.

adapter assembly. Note: Out of the box, the 900 MHz antenna has a TNC connector. I cut off this connector and installed a BNC-style connector. See **Fig. 2** for cable connections within the base.

Tuning

I cut the two-meter antenna element extra long to ensure that I could cut and tune it to the frequency of choice, and allow the antenna element to be inserted deep enough into the adapter assembly to provide mechanical stability (**Fig. 3**). I used the MFJ analyzer (the one with a digital frequency readout and SWR meter) to tune to the 146 MHz frequency and a low SWR reading. Mount the two-meter antenna and its adapter assembly to the mobile antenna base by simply screwing it in for the final time.

To check out the antenna in operation, I mounted the newly converted two-meter antenna and its magnetic base near the center of the top of my vehicle. I connected the coax to the transceiver and listened on the local repeater (146.85 MHz). My QTH is about 15 miles from this machine. I was able to get good signal reports from several mobile and fixed stations. I drove my vehicle up to a speed of 55 mph, then stopped and checked the antenna and its magnetic base. The entire antenna held up very well.

Bonus 70 cm antenna

To make a 70 cm antenna from the original 900 MHz one, measure 7-3/8 inches from the top of the 900 MHz antenna. Mark this spot with suitable masking tape and marking pen. Make the actual cut with a hacksaw or heavy-duty pliers. Screw this new 70 cm antenna into the existing mobile magnetic mount and tighten firmly.

I checked the SWR using a UHF SWR meter. The initial SWR reading at 449.775 MHz was a 1.5-to-1 ratio.

I was able to key our local repeater using low power on the transmit. This produced full quieting.

I figure I sure got my six bucks' worth! 73

Number 32 on your Feedback card

SatTrack: Automatic Antenna Tracking For the Rest of Us

Enjoy tracking satellites even if you don't have a trust fund.

Andrew A. Skattebo KAØSNL
421 N. 10th Street
Petersburg IL 62675-1225

For several years I've been searching for a simple, inexpensive system to add computer automated tracking capability to my satellite station. The workload of pointing antennas and tuning radios during a short satellite pass is exciting but a little too demanding for my taste. This was the main reason I have not been very active on the low-orbit satellites. Up to this time adding automatic tracking capability meant spending a small fortune for the system or home-brewing most of the hardware and software yourself. Normally, a dedicated satellite rotor system must be purchased. Then you have to find a tracking interface to go between your computer and those rotators. This would usually take around $700 to get an automated system going, buying everything off the shelf. Some of the systems claim to offer low-cost satellite tracking but I found that most of these required either an expensive interface and cheaper TV rotators or a low-cost interface and expensive rotors. This still leaves you with one or more expensive components to purchase.

The situation has changed a bit recently with the introduction of the SatTrack system from C&S Engineering. The system uses inexpensive Gemini® TV antenna rotators and a special interface board that goes between your DOS computer and the rotators. The interface board takes the place of the rotor's control boxes and the included software works in conjunction with InstantTrack to control the rotors. With the included software, the board and two rotators, you can have a complete computer-controlled satellite tracking system which can be put together for around $200!

The interface board is available from C&S Engineering three different ways: a kit of parts; a built PC board; and a wired-and-tested unit in an enclosure. The kit version includes all board-mounted components. The builder must populate the supplied PC board and supply all outboard components. For both the kit and built PC board versions the builder supplies a power transformer, all connectors and an enclosure. The completed unit is fully wired and ready to operate as shipped. All three of these options come with the SatTrack software to operate the rotors and a replacement potentiometer to modify one of the rotors. Since this is not a complicated board and does not use any surface-mount components I decided to tackle the kit version and save a few dollars in the process. In addition to the kit, I ordered the rotor mounting plate to adapt the TV rotators to satellite use. This plate allows you to turn one of the rotors on its side for use as an elevation rotor.

Here we go

My package arrived about a week after ordering and I took a quick inventory of the included parts. There is a 3.5-inch diskette with the software, a bag of parts with the PC board and some well-done CAD drawings including a schematic, a parts placement diagram, and a wiring diagram for connector wiring. All other instructions and information are in text files on the disk that may be printed out for your convenience. As mentioned earlier, several components must be supplied by the builder whether you purchased the kit version or the built PC board version (see **Additional Parts**).

Even though the board is fairly straightforward to assemble and

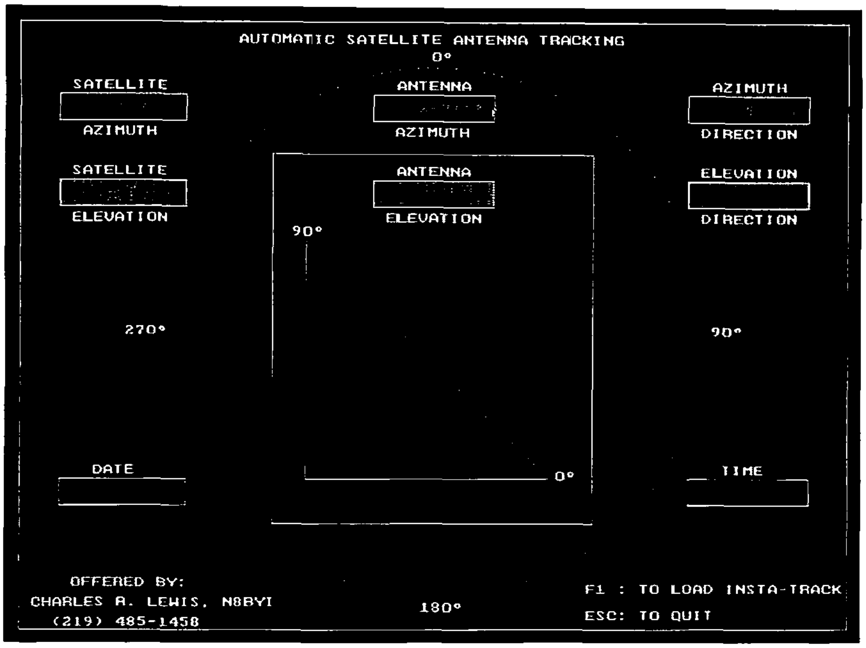


Photo A. *Screen capture showing SatTrack graphical display. Note: The controller is not connected so the display does not show real-time values.*

connect, I am hesitant to recommend it as a "first-time" kit project. There are really no instructions included for building up the board other than the CAD drawings. If you have some previous experience or someone nearby who can help, this is really not a problem. However, if you are not familiar with reading schematics or haven't home-brewed before, you may consider spending the extra money and getting a completed unit. Please be aware that even if you purchase the wired-and-tested SatTrack box you will have to do some surgery to the azimuth rotator, so even this option is not completely "plug & play."

Construction of the PC board simply involves populating the board using the schematic and the parts placement diagram. I was a little rusty at building and had to contact C&S for some clarification on parts identification. Every E-mail to C&S produced a quick and helpful reply so don't hesitate to contact them when a question arises. Once I was squared away on parts identification, the process went pretty fast. It took much more time to do the external wiring and chassis preparation than it did to populate the board.

With the PC board complete, you will need to find a suitable case for the project and make the external connections. I found a nice-looking enclosure at the local Radio Shack™ in the form of a metal box approximately three by eight by six inches. While you're there you can pick up the rest of the required components and you'll be ready to finish the project. To prepare the enclosure you'll need to do some drilling, and two cutouts are required to mount the 9-pin and 25-pin connectors. I used a Dremel™ tool and a template to make the required cuts. They aren't perfect, but it did work pretty well. For the power supply hookup, I used a three-prong grounded cable. I felt better about using a grounded cable since the rotor cable was going outside and up the tower. Also, no power switch is included in the diagrams, but I chose to include one on the front panel. Many of these little details are left up to the builder's skills and discretion. This gives you the opportunity to "customize" your project to suit your needs.

With the board assembled and put in the enclosure, it's time to modify the azimuth rotor. This modification involves replacing the potentiometer in the rotator with a new one supplied with your SatTrack unit. Instructions on this modification are included in a text file and detail the steps necessary to complete the task. I was a little intimidated at first, but the operation was simple and took just over an hour to complete. When disassembling the rotor I recommend labeling all the gears so you have no problem getting everything back in the proper order. The shaft of the replacement pot must be cut down and notched to match the original unit. You can use the old pot as a guide and grind or cut the new shaft to match. With that done, replace

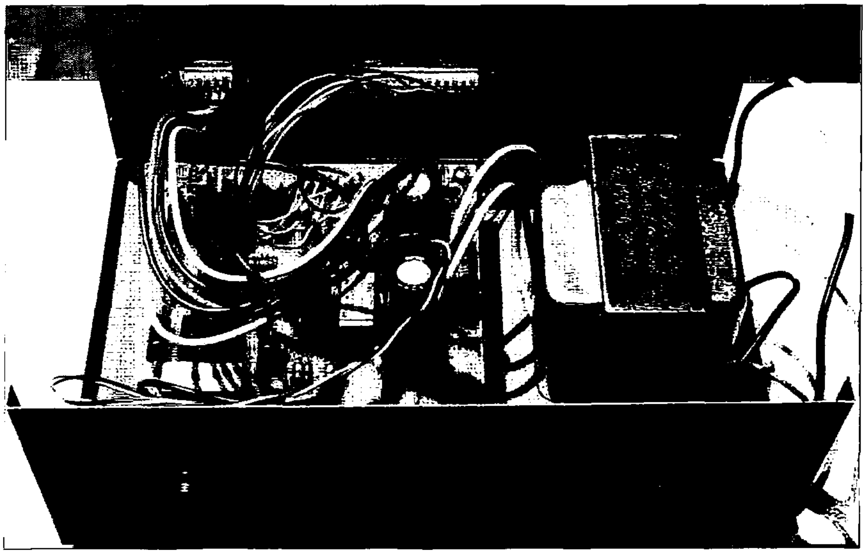


Photo B. *The rotor control board completed and mounted in an aluminum box.*

the pot and reassemble the gears. The new pot is larger than the original, so before replacing the bottom cover of the rotor, a hole must be cut in it to allow for clearance of the new (larger) pot. A hole saw on the hand drill made quick work of that. Remember, even if you purchase a complete wired and tested interface you will need to complete this modification to the rotor.

No modifications are needed to the elevation rotor, so at this point you can mount the two rotors on a section of mast and prepare to calibrate the rotors. The mounting adapter plate from C&S is well worth the low price. This plate allows mounting of your elevation rotor directly to the azimuth rotor. When using this plate, however, you will need to cut the rotor mounting bolts to 3/4-inch to allow for clearance against the housing. Also, with the rotor turned sideways some form of weather protection must be provided. I used some automotive Fiberglas™ to make a cover for the rotors. You may be able to find something at your local discount center that will work.

For the calibration work I set up a short mast and tripod indoors, since you need access to both your computer and the rotors during calibration. C&S Engineering recommends that the length of rotor cable you will use be connected at the time of calibration. This will keep any resistance in the cable from changing the readings of the pots. I chose a heavy-duty "R2" rotor cable from The Radio Works (**Additional Parts**). This cable has two #16 conductors and six #18 conductors.

For the calibration routines, you should follow the directions in the calibration text file included on the disk. With the program prompts and the documentation, the calibration process is pretty straightforward. Follow the instructions and you should have no trouble. I do have two notes, though, on the calibration of the azimuth rotor. If you use the mounting plate adapter, the rotor will operate opposite that of one mounted on its standard mounting bracket since the stationary mast goes through the middle instead of attaching on the side. Just be sure that when you do the calibration the rotor moves clockwise when you command "clockwise" and vice versa. If you are using the mounting plate and it moves opposite, simply reverse the wires going to "azimuth motor" and "motor ground" to get you moving in the right direction. Additionally, be sure that the count from the pot goes up when moving clockwise, and down when going counterclockwise. If you mixed up the wires when installing the new pot this may be backwards. If this is the case, switch the two wires to restore correct operation.

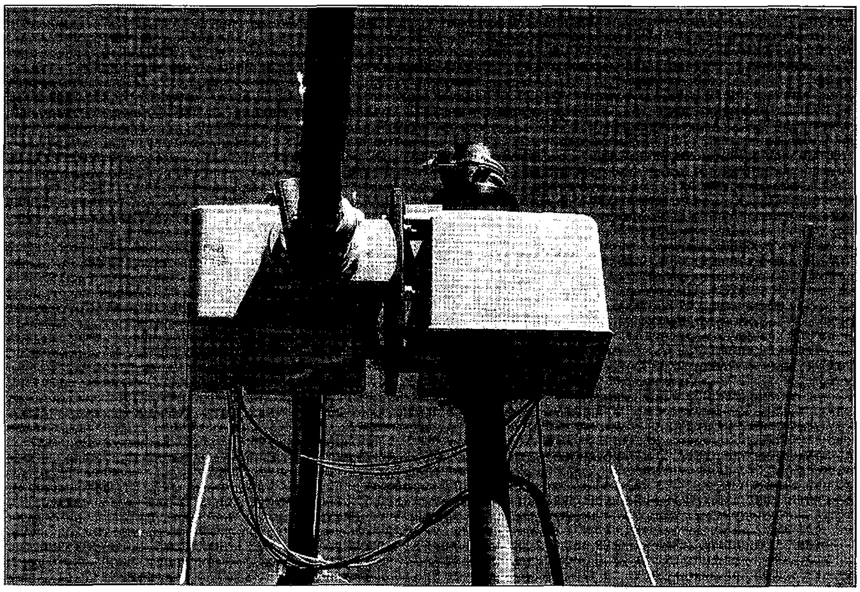


Photo C. Photo showing rotor mounting using adapter plate. Note hole in bottom of azimuth rotor for new pot.

Take it home

Once the calibration process is complete, the system is ready for use. Operation of the system is detailed in yet another text file on the disk. First, run the program sattrack.exe (or satttrktx.exe). This will load the necessary TSRs and then will call and load InstantTrack. You select the satellite to track in InstantTrack, and then type "R" to select the rotor driver. Next, exit InstantTrack and the SatTrack program will display satellite position and rotor position. Unfortunately, the SatTrack software does not run in the background, as other rotor drivers do. This means you will see the SatTrack tracking screen instead of InstantTrack itself. Once activated, the system will always go to a "home" position of 0° elevation and 360° azimuth before starting to track an object. I found this procedure can take up to two minutes, so plan to select the satellite and start tracking a couple of minutes prior to the start of the pass. With my old 286 computer running the SatTrack software, performance of the tracking was improved by using the text version (sattrktx.exe) of the software. The graphical version seemed to require more of my computer's resources, and antenna pointing lagged behind the satellite position up to 8° on fast moving targets. This was nearly eliminated by using the text version. If you're using a faster computer this shouldn't be a factor. Also, since the beamwidth of the VHF/UHF beams I'm using is greater than 30° the small error in tracking wasn't noticeable anyway.

I have had a great time operating my newly automated antennas but there are a few things to keep in mind about this system and its limitations. First, these are lightweight TV-type rotators—they won't handle a large array and are sensitive to the balance of the antennas. Second, this system may not be the best choice if you're into digital satellite operation since the software is not compatible with the popular Wisp™ station automation software.

Additional Parts
(most available from Radio Shack™)

25.2 V 2 A transformer (RS 273-1512)
metal standoffs for board mounting
power cord
1/4 A fuses & holder
power switch
enclosure (RS 270-274)
male and female DB-9 connectors
DB-25 female connector
DB-25 male-to-male computer cable

R2 rotor cable is available from The Radio Works, P.O. Box 6159, Portsmouth VA 23703; telephone (800) 280-8327 (and other suppliers).

The software is designed to operate only with InstantTrack—no other popular software is supported although I have multi-tasked the program with my own favorite tracking program under Win95™ without any problems.

With that said, I still feel the SatTrack system is a great way to gain automatic antenna tracking—without breaking the bank. Use of this low-cost system has made working low orbit satellites, including the shuttle and *Mir*, much more enjoyable. I was even able to use the system on Field Day this year and it performed flawlessly running on battery power (with an inverter) in a portable situation. I am having a great time using my new station capabilities and I feel this system would be a great addition to any budget-minded satellite enthusiast's station. 73

73's DX Dynasty Award

This is the current list of DXDA award winners. The DX Dynasty Award is the most enjoyable DX award around. Any correspondence concerning DXDA should be addressed to DXDA, c/o *73 Magazine*, 70 Route 202 N, Peterborough NH 03458 USA.

BASIC AWARD—100 COUNTRIES WORKED

1. W1RFW
2. WB2DIN
3. KT1A
4. W3FDU
5. KA9JOL
6. WB1BVQ
7. NW7O
8. AK4H
9. W3HCW
10. KZ2W
11. K9FD
12. WD5N
13. KA9TNZ
14. K9GBN
15. N5GAP
16. WB3FMA
17. NN6E
18. AL7HG
19. N6CGB
20. KI6AN
21. K9JPI
22. N4WF
23. K6PKO
24. KW7J
25. VE6JO
26. WA4IUV
27. W4ZFE
28. N4KMY
29. WØHBH
30. K8KJN
31. KG1V
32. K1KOB
33. KY3F
34. PY2JY
35. YB5BEE
36. YB5BEH
37. WB9SBO
38. NØAFW
39. KA9MOM
40. N3II
41. W6DPD
42. KE8GG
43. VE6VK
44. KD9RD
45. W4WJJ
46. KØHSC
47. KI6GI
48. IK1APP
49. KJ4RR
50. K8MDU
51. N1EIU
52. K1DRN
53. WD8REC
54. ZL2BLC
55. VE3EFX
56. W9MCJ
57. N6IV
58. KN8D
59. KC5YQ
60. WB6ITM
61. KA2AOT
62. K4LHH
63. VE2QO
64. KE5AT
65. W9SU
66. W3OOU
67. NR2E
68. KF5PE
69. N3FBN
70. KB4SJD
71. N3EZX
72. IK8GCS
73. WB4I
74. NG1S
75. WB7UUE
76. HK4EB
77. KØBFR
78. N7GMT (KF7SH)
79. AA4VN
80. KA1LMR
81. N8AXA
82. NM2I
83. KD9YB
84. HC2CG
85. VE1BXI
86. YC2OK
87. N4GNL
88. GM3UBF
89. 5Z4BP
90. IØAOF
91. VE1BN
92. KA2NRR
93. 5Z4DU
94. KB8ZM
95. HK4CCW
96. W2JQ
97. HC2AGT
98. WD5N/M
99. VE1BHR
100. VE1AGZ
101. K5AOB
102. KW2D
103. PY3ARZ
104. WB4ETD
105. N2FPB
106. KD3CQ
107. K4NNK
108. VU2DNR
109. AA5BE
110. PY3OG
111. VE4ACF
112. VE4SI
113. PJ2KI
114. WB4CKY
115. W6EQB
116. KK4IY
117. IK1IYU
118. N8GCN
119. KB1AF
120. KB8BHE
121. KE2CG
122. VS6CT
123. G3IZQ/W
124. WB6FNI
125. KAØIAR
126. K9SM
127. W6BCQ
128. KA5MSL
129. WB4FLB
130. N7GLT
131. WAØX
132. KF4GW
133. N4QGH
134. VE1CBK
135. 7J1AAL
136. K6ICS
137. NZ7W
138. WBØN
139. WC7F
140. F6IFE
141. KL7N
142. KE8LM
143. WA6YOO
144. VE2MFD
145. N3APQ
146. HK1DBO
147. NM3V
148. IK6GFY
149. WB6UAN/M
150. NK6Z
151. KB6IUA
152. W9OKH
153. WB5FXT
154. NB3E
155. N2ESP
156. YU2EJU
157. OZ1DXX
158. IK5IIU
159. KA1ION
160. KD3AI
161. OK1AEH
162. W9LCR
163. 8P6SH
164. KA6SPQ
165. ZF2KH
166. W6MVV
167. JA8CAQ
168. KI6WF
169. K2MRB
170. AA6GM
171. JAØSU
172. NU8Z
173. GØGRK
174. YB8VM
175. DV1BRM
176. WØTU
177. N7CNH
178. PY3IO
179. YBØZCA
180. YBØAF
181. VE3PQB
182. W2SV
183. N1ADE
184. WP4AFA
185. KS7V
186. W2OFB
187. G4ASL
188. N5JUW
189. KA8WAS
190. 5NØWRE
191. AA4IP
192. JR5KDR
193. KD2WQ
194. KA3NIL
195. WA8YWK
196. VE1ACK
197. HP2XVB
198. WB5KYK
199. N5JUJ
200. N4OBJ
201. 9Q5NW
202. KW2D
203. VE1HA
204. HP8BSZ
205. IK8JJQ
206. YC3DKN
207. I3VKW
208. K2EWA
209. KD3CR
210. N9GDG
211. KF8K
212. FD1BEG
213. DU1DZA
214. N8IMZ
215. KK4YA
216. LU1JDL
217. KA8YYZ
218. KA4TMJ
219. WA9DDC
220. YI1CIS
221. YC3FNL
222. GØFWG
223. KV4B
224. N5IET
225. WA9WIG
226. N3CDA
227. KE6KT
228. IK7DBB
229. JY5EC
230. N1ETT
231. PY2DBU
232. I8IYW
233. NØISL
234. KC4BEB
235. WA7QQI
236. KA1RJG
237. OZ9BX
238. KB4HBH
239. KA3RWP
240. NJ1T
241. W4DCG
242. YCØRX
243. VE7OJ
244. AA4W
245. N9GMM
246. KB4HBH
247. KM4HF
248. CE1YI
249. KA1FVY
250. N2GVB
251. N2DAO
252. WF8E
253. YBØHZL
254. N5MBD
255. N4SNS
256. KA3TGY
257. JN3XLY
258. N4DUV
259. KA9MRU
260. KA4OTB
261. N4JED
262. AB4KA
263. WA7OET
264. KA3RVH
265. CE7ZK
266. NI9J
267. WB9PTN
268. KB8DAE
269. WØCL
270. WB7VUB
271. JF6TUU
272. ZY3IO
273. KB4VIR
274. OE6CLD
275. N7JJQ/DU3
276. KK4FB
277. DU1AUJ
278. K2EWB
279. NI5D
280. N2JXC
281. NØIWT
282. WB3BDH
283. K1CVF
284. KA3CXG
285. KA1SPO
286. WA4NWT
287. KJ4OI
288. KA3UNQ
289. WB2VMV
290. KD4MM
291. OE3DHS
292. KD9HT
293. DL8OBC
294. G3KVA
295. WA4NEL
296. KA4VZO
297. NØIDT
298. KA1FUE
299. KD7EO
300. JH8MWW

301. KB8ICD
302. JA1CKE
303. N3GEE
304. JA5MG
305. KA1FTU
306. WA8KMK
307. N2IBW
308. N4THE
309. N3CYD
310. JA4TF
311. W6YLL
312. WA1S
313. KC5WA
314. N6WK
315. PY4OY
316. KG7BO
317. WB3FQY
318. WCØA
319. VE4AMU
320. YCØMCA
321. WA3LEU
322. KB2GLO
323. OZ1FNX
324. K6GCF
325. KC4PCX
326. KA7EXD
327. DK9EA
328. HL5AP
329. SM7BRO
330. ON6DP
331. WA3KKO
332. KB9ABI
333. DA2UI
334. SMØBNK
335. WA2BMQ
336. WAØQIT
337. 5Z4BH
338. KB9ALG
339. OA4ANR
340. OD5ZZ
341. VE3ZD
342. LU2ATR
343. HL5FRG
344. UB5LRS
345. N1ICC
346. UY5XE
347. PS7AB
348. IK4NPC
349. KD1CT
350. DU1CHD
351. UB4WZA
352. LU3CF
353. G7AZP
354. VE5AAD
355. IK3ITX
356. SM4SEF
357. N9CPK
358. VE2JWK
359. N7JXS
360. KO4VO
361. JE1GWO
362. JM2DRM
363. IK1SLE
364. JF7QUE
365. HL5BUV
366. VE3GLX
367. N7QXQ
368. JE6KLR
369. KK6JY
370. N2BI
371. KK4XL
372. JA3SSB
373. KBØADI
374. I1-50156
375. VU2SMN
376. EA6AAK
377. N3IHS
378. N8MOT
379. KB2NEK
380. PY2DBU
381. WA2CKP
382. WB2PPN
383. JA1-2Ø762/BV
384. AB4ZD
385. YC8EMH
386. WA8RLB
387. N5VWM
388. VE7SKB
389. KB4BCC
390. VE7GSE
391. YC8BWN
392. KN6ER
393. KD1CJ
394. G2BFO
395. KB7ROK
396. VK2EQ
397. 4X4-2175
398. JE1BGL
399. KF2LC
400. WV2X
401. LU5EWO
402. WAØCLR
403. VO1UL
404. VE6AML
405. WD4REX
406. WAØCLR
407. VE3VJC
408. WA1MKS
409. JH6FHJ
410. JE9EMA
411. WK8X
412. TI2YLL
413. KP4WN
414. KD6MOS
415. KI7CM
416. JH1IED
417. JN6MIC
418. BU7FC
419. DL1EMO
420. KD4TWP
421. 5W1GC
422. JA7JI
423. W5RUK
424. LU3OJZ
425. WD4OHD
426. 7L1MFS
427. ON4BCM
428. WØUHL
429. N4WJV
430. LU5DSE
431. HS1NGR
432. DU1SAN
433. 4X/G3WQU
434. K3BSA
435. CP8AK

150 COUNTRIES ENDORSEMENT

1. WB2DIN
2. N4WF
3. N6CGB
4. K9FD
5. NØAFW
6. N3II
7. WB1BVQ
8. KA2AOT
9. KI6GI
10. N7GMT
11. IK8GCS
12. IK1APP
13. VE6JO
14. VE4ACF
15. WB4I
16. IK1IYU
17. KE2CG
18. G3IZQ/W1
19. WB6FNI
20. K8MDU
21. VE6VK
22. KB6IUA
23. WB5FXT
24. YU2EJU
25. IK5IIU
26. KE8LM
27. KA1ION
28. KA6SPQ
29. W6MVV
30. JA8CAQ
31. KI6WF
32. JAØSU
33. WD5N
34. W2SV
35. W6BCQ
36. F6IFE
37. VE2MFD
38. WP4AFA
39. 5NØWRE
40. KD2WQ
41. VE1ACK
42. N5JUJ
43. 9Q5NW
44. KB8BHE
45. I3VKW
46. KD3CR
47. N8IMZ
48. GØFWG
49. N2FPB
50. KE6KT
51. OZ9BX
52. NJ1T
53. CE1YI
54. YBØHZL
55. JN3XLY
56. KA9MRU
57. CE7ZK
58. KB8DAE
59. K2EWB
60. NI5D
61. KD3CQ
62. KA4OTB
63. WB2VMV
64. KD4MM
65. KD9HT
66. KA3NIL
67. NØIDT
68. KA1TFU
69. KA4TMJ
70. JA4TF
71. KA3UNQ
72. KB8ZM
73. K2EWA
74. WA1S
75. PY4OY
76. WCØA
77. OZ1FNX
78. KA7EXD
79. ON6DP
80. VE1RJ
90. N6WK
91. WA3KKO
92. KB9ABI
93. SMØBNK
94. WAØQIT
95. 5Z4BH
96. OA4ANR
97. OD5ZZ
98. VE3ZD
99. HL5FRG
100. UB5LRS
101. PS7AB
102. KD1CT
103. DU1CHD
105. IK3ITX
106. VE2JWK
107. N7JXS
108. JM2PRM
109. HL5BUV
110. VE3GLX
111. KK6JY
112. EA6AAK
113. N3IHS
114. WA2CKP
115. VE6AML
116. WAØCLR
117. WA1MKS
118. KD6MOS
119. KP4WN
120. LU5EWO
121. 5W1GC
122. JA7JI
123. W5RUK
124. LU3OJZ
125. ON4BCM
126. WØUHL
127. N4WJV
128. LU5DSE
129. VO1UL
130. DU1SAN
131. 4X/G3WQU

200 COUNTRIES ENDORSEMENT

1. N3II
2. WB2DIN
3. K9FD
4. IK8GCS
5. NØAFW
6. WB1BVQ
7. VE4ACF
8. KI6GI
9. N6CGB
10. K8MDU
11. YU2EJU
12. KE8LM
13. WD5N
14. F6IFE
15. 5NØWRE
16. KE2CG
17. I3VKW
18. CE1YI
19. W6BCQ
20. CE7ZK
21. KB8DAE
22. K2EWB
23. KD3CQ
24. KD4MM
25. KD9HT
26. KA4TMJ
27. N7GMT
28. JA4TF
29. K2EWA
30. WA1S
31. PY4OY
32. ON6DP
33. VE1RJ
34. WA3KKO
35. WAØQIT
36. 5Z4BH
37. HL5FRG
38. JA1-2Ø762/BV
39. VE6AML
40. LU5EWO
41. 5W1GC
42. JA7JI
43. W5RUK
44. LU3OJZ
45. WØUHL
46. N4WJV
47. VO1UL
48. DU1SAN

250 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. WD5N
4. K8MDU
5. KE2CG
6. CE1YI
7. CE7ZK
8. K2EWB
9. KD9HT
10. N7GMT
11. KD3CQ
12. KB8DAE
13. WA1S
14. PY4OY
15. VE1RJ
16. 5Z4BH
17. N2BI
18. I1-50156
19. VE6AML
20. KB8ZM
21. LU5EWO
22. JA7JI
23. W5RUK
24. WØUHL

300 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. K2EWB
4. K8MDU
5. N7GMT
6. WA1S
7. PY4OY
8. KD3CQ
9. VE1RJ
10. UY5XE
11. IK3ITX
12. VU2SMN
13. JA7JI
14. W5RUK

350 COUNTRIES ENDORSEMENT

1. WB2DIN
2. PY4OY
3. UB4WZA
4. JA7JI
5. KD3CQ

Number 38 on your Feedback card

OFFICIAL DX DYNASTY COUNTRIES LIST: 1/98

AFGHANISTAN	YAØ
AGALEGA ISLAND	3B6
ALAND ISLANDS	OHØ
ALASKA	KL7
ALBANIA	ZA
ALGERIA	7T-7Y
AMERICAN SAMOA	KH8
AMSTERDAM AND ST PAUL ISLAND	FT5Z
ANDAMAN ISLAND	VU
ANDORRA	C3
ANGOLA	D2, D3
ANGUILLA	VP2E
ANNABON ISLAND	3CØ
ANTARCTICA	CE9, KC4
ANTIGUA	V2
ARGENTINA	LO-LW
ARMENIA	EK
ARUBA	P4
ASIATIC RUSSIA	UA-UI8, 9, Ø, RA-RZ
ASCENSION ISLAND	ZD8
AUCKLAND ISLAND	ZL9
AUSTRALIA	VK
AUSTRIA	OE
AVES ISLAND	YVØ
AZERBAIJAN	4J, 4K
AZORES ISLANDS	CU
BAHAMA ISLANDS	C6
BAHRAIN	A9
BAKER ISLAND	KH1
BALEARIC ISLANDS	EA6-EH6
BANABA ISLAND	T33
BANGLADESH	S2
BARBADOS	8P
BARBUDA	V2
BELARUS	EU-EW
BELGIUM	ON-OT
BELIZE	V3
BELAU (W. CAROLINE I.)	KC6, T8
BENIN	TY
BERMUDA	VP9
BHUTAN	A5
BOLIVIA	CP
BONAIRE, CURACAO	PJ2,4,9
BOTSWANA	A2
BOVET ISLAND	3Y
BRAZIL	PP-PY
BRIT CYPRUS	ZC4
BRITISH VIRGIN ISLANDS	VP2V
BRUNEI	V8
BOSNIA-HERZEGOVINA	T9
BOUVET	3Y
BULGARIA	LZ
BURKINA FASO	XT
BURUNDI	9U
CAMBODIA	XU
CAMEROON	TJ
CAMPBELL ISLAND	ZL9
CANADA	VE, VO, VY
CANARY ISLANDS	EA8-EH8
CAPE VERDE ISLANDS	D4
CAYMAN ISLANDS	ZF
CENTRAL AFRICA	TL
CENTRAL KIRIBATI	T31
CEUTA AND MELILLA	EA9-EH9
CHAD	TT
CHAGOS	VQ9
CHATHAM ISLAND	ZL7
CHILE	CA-CE
CHINA	BY, BT
CHRISTMAS ISLAND	VK9X
CLIPPERTON ISLAND	FO
COCOS ISLAND	TI9
COCOS-KEELING ISLAND	VK9C
COLOMBIA	HJ, HK
COMOROS	D6
CONGO	TN
CONWAY REEF	3D2
COOK ISLAND	ZK1
CORSICA	TK
COSTA RICA	TI, TE
CRETE	SV9
CROATIA	9A
CROZET ISLAND	FT5W
CUBA	CM, CO
CURACAO	PJ
CYPRUS	5B
CZECH REPUBLIC	OK, OL
DENMARK	OZ
DESECHEO ISLAND	KP5
DJIBOUTI	J2
DODECANESE ISLANDS	SV5
DOMINICA	J7
DOMINICAN REPUBLIC	HI
EASTER ISLAND	CEØ; Y
EAST KIRIBATI	T32
EAST MALAYSIA	9M6, 9M8
ECUADOR	HC, HD
EGYPT	SU
EL SALVADOR	YS
ENGLAND	G, GX, M
EQUATORIAL GUINEA	3C
ESTONIA	ES
ERITREA	E3
ETHIOPIA	ET
EUROPA ISLAND	FR/E
EUROPEAN RUSSIA	UA-UI1, 3, 4, 6, RA-RZ
FALKLAND ISLANDS	VP8
FAROE ISLANDS	OY
FERNANDO DE NORONHA	PPØ, PYØ
FIJI ISLANDS	3D2
FINLAND	OF-OI
FRANCE	F
FRANZ JOSEPH LAND	R1FJ
FRENCH GUIANA	FY
FRENCH POLYNESIA	FO
FUTUNA ISLAND	FW
GABON	TR

GALAPAGOS ISLAND	HC8, HD8
GAMBIA	C5
GEORGIA	4L
GERMANY (FED REP OF)	DA-DL, Y2-Y9
GHANA	9G
GIBRALTAR	ZB2
GLORIOSO ISLAND	FR/G
GOUGH ISLAND	ZD9
GOZO ISLAND	9H
GREECE	SV-SZ
GREENLAND	OX
GRENADA	J3
GUADELOUPE	FG
GUAM	KH2
GUANTANAMO BAY	KG4
GUATEMALA	TG, TD
GUERNSEY	GU, GP, MU
GUINEA	3X
GUINEA-BISSAU	J5
GUYANA	8R
HAITI	HH
HAWAII	KH6, KH7
HEARD ISLAND	VKØ
HONDURAS	HQ, HR
HONG KONG	VS6, VR2
HOWLAND ISLAND	KH1
HUNGARY	HA, HG
ICELAND	TF
INDIA	VU
INDONESIA	YE-YH
IRAN	EP, EQ
IRAQ	YI
IRELAND	EI, EJ
ISLE OF MAN	GD, GT, MD
ISRAEL	4X, 4Z
ITALY	I
ITU GENEVA	4U_ITU
IVORY COAST	TU
JAMAICA	6Y
JAN MAYEN ISLAND	JX
JAPAN	JA-JS
JARVIS ISLAND	KH5
JERSEY	GJ, GH, MJ
JOHNSTON ISLAND	KH3
JORDAN	JY
JUAN DE NOVA ISLAND	FR/J
JUAN FERNANDEZ ISLAND	CEØ; Z
KALININGRAD	UA2
KAZAKHSTAN	UN-UQ
KENYA	5Y-5Z
KERGUELEN ISLAND	FT5X
KERMADEC ISLAND	ZL8
KINGMAN REEF	KH5K
KURE ISLAND	KH7K
KUWAIT	9K
KYRGYZSTAN	EX
LACCADIVE ISLANDS	VU
LAOS	XW
LATVIA	YL
LEBANON	OD
LESOTHO	7P
LIBERIA	EL
LIBYA	5A
LIECHTENSTEIN	HBØ
LITHUANIA	LY
LORD HOWE ISLAND	VK9L
LUXEMBOURG	LX
MACAO	XX9
MACEDONIA	Z3
MACQUARIE ISLAND	VKØ
MADAGASCAR	5R-5S
MADEIRA ISLAND	CT3
MALAWI	7Q
MALDIVE ISLANDS	8Q
MALI	TZ
MALPELO	HKØ
MALTA	9H
MALYJ-VYSTOSKIJ (M-V) ISLAND	R1MV
MARIANA ISLAND	KHØ
MARION ISLAND	ZS8
MARKET REEF	OHØ; M
MARSHALL ISLAND	V7
MARTINIQUE	FM
MAURITANIA	5T
MAURITIUS ISLAND	3B8
MAYOTTE	FH
MELLISH REEF	VK9M
MEXICO	XA-XI
MICRONESIA	V6
MIDWAY ISLAND	KH4
MINAMI-TORI-SHIMA	JD1
MOLDOVA	ER
MONACO	3A
MONGOLIA	JT-JV
MONTSERRAT	VP2M
MOROCCO	CN
MOUNT ATHOS	SV/A
MOZAMBIQUE	C8-9
MYANMAR	XY, XZ
NAMIBIA	V5
NAURU	C2
NAVASSA ISLAND	KP1
NEPAL	9N
NETHERLANDS	PA-PI
NETHERLANDS ANTILLES	PJ
NEVIS ISLAND	V4
NEW CALEDONIA	FK
NEW ZEALAND	ZL, ZM
NICARAGUA	YN
NICOBAR ISLAND	VU
NIGER	5U
NIGERIA	5N, 5O
NIUE ISLAND	ZK2
NORFOLK ISLAND	VK9N
NORTH COOK I.	ZK1
NORTH KOREA	P5
NORTHERN IRELAND	GI, GN, MI
NORWAY	LA-LN
OGASAWARA ISLAND	JD1
OMAN	A4
PAKISTAN	AP-AS
PALMYRA ISLAND	KH5

PANAMA	HO, HP
PAPUA NEW GUINEA	P2
PARAGUAY	ZP
PERU	OA-OC
PETER 1ST ISLAND	3Y
PHILIPPINES	DU-DZ
PHOENIX	T31
PITCAIRN ISLAND	VR6
POLAND	SN-SR
PORTUGAL	CT
PRATAS I.	BV9P
PRINCE EDWARD ISLAND	ZS8
PRINCIPE	S9
PROVIDENCIA ISLAND	HKØ
PUERTO RICO	KP3, KP4
QATAR	A7
REUNION ISLAND	FR
REVILLA GIGEDO ISLAND	XA4-XI4
RODRIGUEZ ISLAND	3B9
ROMANIA	YO-YR
ROTUMA ISLAND	3D2
RWANDA	9X
SABLE ISLAND	CYØ
SAN ANDRES ISLAND	HKØ
SAN FELIX AND SAN AMBROSIO	CEØ; X
SAN MARINO	T7
SAO TOME	S9
SARDINIA	ISØ,IMØ
SAUDIA ARABIA	HZ
SCARBOROUGH REEF	BS7
SCOTLAND	GM, GS, MM
SENEGAL	6V, 6W
SEYCHELLES	S7
SIERRA LEONE	9L
SINGAPORE	9V
SINT MAARTEN, SABA, AND SINT EUSTATIUS ISLANDS	PJ5-8
SLOVAK REPUBLIC	OM
SLOVENIA	S5
SMOM (MALTA)	1AØ
SOCOTRA ISLAND	7O
SOLOMON ISLANDS	H4
SOMALIA	T5
SOUTH AFRICA	ZR-ZU
SOUTH COOK I.	ZK1
SOUTHERN SUDAN	STØ
SOUTH GEORGIA ISLAND	VP8, LU
SOUTH KOREA	HL, DS
SOUTH ORKNEY ISLAND	VP8, LU
SOUTH SANDWICH ISLAND	VP8, LU
SOUTH SHETLAND ISLAND	VP8, LU, CE9, HFØ, 4K1
SPAIN	EA-EH
SPRATLY ISLAND	IS
SRI LANKA	4P-4S
ST BRANDON ISLAND	3B7
ST HELENA ISLAND	ZD7
ST KITTS	V4
ST LUCIA	J6
ST MARTIN ISLAND	FJ
ST PETER AND ST PAUL ROCKS	PPØ-PYØ
ST PIERRE ISLAND AND MIQUELON	FP
ST PAUL ISLAND	CY9
ST VINCENT	J8
SUDAN	ST
SURINAME	PZ
SUVA	3D2
SVALBARD ISLAND	JW
SWAZILAND	3DA
SWEDEN	SA-SM
SWITZERLAND	HB
SYRIA	YK
TADZHIK	UJ
TAIWAN	BV
TAJIKISTAN	EY
TANZANIA	5H, 51
TASMANIA	VK7
THAILAND	HS, E2
TOGO	5V
TOKELAU	ZK3
TONGA ISLAND	A3
TRINDADE AND MARTIM VAZ	PPØ, PYØ
TRINIDAD & TOBAGO	9Y-9Z
TRISTAN DE CUNHA	ZD9
TROMELIN ISLAND	FR/T
TUNISIA	3V
TURKEY	TA-TC
TURKMENISTAN	EZ
TURKS AND CAICOS ISLANDS	VP5
TUVALU	T2
UGANDA	5X
UKRAINE	UR-UZ, EM-EO
UNITED ARAB EMIRATES	A6
UNITED KINGDOM SOV BASES ON CYPRUS	ZC4
UNITED NATIONS-GENEVA	4U1
UNITED NATIONS-NEW YORK	4U_UN
UNITED NATIONS-VIENNA	4U1
UNITED STATES OF AMERICA	K, W, N, AA-AK
URUGUAY	CV-CX
UZBEKISTAN	UJ-UM
VANUATU	YJ
VATICAN CITY	HV
VENEZUELA	YV-YY
VIETNAM	3W, XV
VIRGIN ISLANDS	KP2
WAKE ISLAND	KH9
WALES	GC, GW, MW
WALLIS ISLAND	FW
WAYNE GREEN	W2NSD
WESTERN CAROLINE ISLAND (BELAU)	KC6, T8
WEST KIRIBATI (GILBERT I.)	T3Ø
WESTERN SAHARA	SØ
WESTERN SAMOA	5W
WEST MALAYSIA	9M2, 9M4
WILLIS ISLAND	VK9W
WORLD BANK	4U1
YEMEN	7O
YUGOSLAVIA	YT, YU, YZ
YUKON	VY1
ZAIRE	9Q-9T
ZAMBIA	91, 9J
ZANZIBAR	5H1
ZIMBABWE	Z2

1997 ANNUAL INDEX

Ask Kaboom	RF transmitting circuits	KB1UM	NOV 63
Ask Kaboom	More transmitters	KB1UM	DEC 52
Carr's Corner	RadioScience Observing	K4IPV	SEP 50
Ham to Ham	Adjustable ant., paper, cable	NZ9E	JAN 54
Ham to Ham	Virus protect, equalizing resistors	NZ9E	FEB 51
Ham to Ham	Stud mounting, heat buildup	NZ9E	MAR 82
Ham to Ham	Test signal, varicaps	NZ9E	APR 53
Ham to Ham	AA cells, cleaning pots	NZ9E	MAY 60
Ham to Ham	Computer power supplies	NZ9E	JUN 84
Ham to Ham	Multimedia amplifiers	NZ9E	JUL 59
Ham to Ham	Mysterious capacitor, RS-12 sat.	NZ9E	AUG 52
Ham to Ham	Liqd Nails™, RS-12 sat., X-Acto™	NZ9E	SEP 54
Ham to Ham	Power, mobile antennas	NZ9E	OCT 78
Ham to Ham	LEDs, j-pole	NZ9E	NOV 57
Ham to Ham	Short circuit finder	NZ9E	DEC 82

Construction

A Baycom-Style HF PSK Modem	Build a packet modem from scratch	VK4AOC,VK4TN	NOV 46
A Flexible Keyer	A weekend of investment	W2GOM/7	JAN 17
A Full-Time Space Shuttle Monitoring Station	Carrier-operated relay featured	K4DRF	MAR 51
Antenna Tuners	Do we really need them?	W6YBT	FEB 21
Are You Ready to Recharge?	bq2903 charger chip	N4UAU	MAR 40
A Well-Regulated Power Adapter	Add some stability	N8PTG	JAN 69
An Enhanced Automatic Voltage Controller	Make this project even more useful	N4UAU	JAN 42
Board Creation Tips	Seven steps to beautiful PC boards	KC5AWJ	AUG 38
Build an Audio Multiplexer	For your frequency counter	KB8XI	MAY 10
Build a Colloidal Silver Generator	Antibiotic substance	WA8YKN	APR 21
Build the Bioelectrifier	Reprint plus update	WA8YKN	MAY 13
Build the Mag-Glass	Through-glass magnetic mount	AH2AR/5	JUN 21
Build the Turbo Digi-Sniffer	Digital field-strength meter	AH2AR/5	FEB 26
Build This Receiver Preamplifier	Use almost anything for an ant.	W9QHV	JAN 26
Colby's Do Something Box	A great gift gadget for kids	W7RXV	NOV 31
Electronic Construction A to Z Part 1	Everything about building stuff	AAØXI/VK5FN	NOV 21
Electronic Construction A to Z Part 2	Everything about building stuff	AAØXI/VK5FN	DEC 31
Elegant Rotating—Revisited	Beam-aiming circuit	W6ZZB	FEB 17
Home-Brew Transistor/Diode Tester	Not just blinking lights	Bowman	MAY 69
Is Your Mixer Circuit Mixing Like It Should?	Test circuits	N2DCH	MAY 44
Make a Ten-to-One Probe	Easier troubleshooting	AD4UA	JUN 67
Negative Resistance RF Preselector	Soup up that old superhet	W2GOM/7	AUG 21
NiCd Health Maintenance System	Get maximum life out of NiCds	N4UAU	JUN 35
Power Monitor/Distribution Panel	Early warning system	KB4ZGC/W4LJD	APR 44
RF Voltage and Power Meter	Easy-to-build instrument	WI5W	NOV 67
The Hale-Bopp Comet...	Build the Cosmic Crystal Set	WA8YKN	APR 10
The ScopeMixer	Ham radio systems integration	N6GKC	JAN 10
The Topbander	Ant. tuner for 160m	W8ND	FEB 23
Trees Are for the Birds	PVC—the ham's secret weapon	NØBLX	OCT 31

CW, Code

ARRL Code Survey	Should code be kept ...?	AC5HU	MAR 35
Finding His Voice	Hospitalized dad uses CW	Sanders,KB6MTV	JUL 45
Frequency and CW CQs	Zero-beat your transmitter	W6BNB	AUG 71
Keys to Days Gone By	Keyer collection	Seay	AUG 76
Let's Keep CW Alive!	It's distinctive, useful, fun	WF6P	JUL 81
Let Your Fingers Do the Talking	... or, wire you smiling?	WF6P	DEC 67
Limit Morse Code Testing to 5 WPM	For any class license	KB7PNQ	APR 36

Digital Modes

The Digital Port	Connect to the local BBS	KB7NO	JUN 76
The Digital Port	Windows 95™ comm port problem	KB7NO	JUL 71
The Digital Port	TNC Commands	KB7NO	AUG 61
The Digital Port	BayPac™ BP-2M multimode	KB7NO	SEP 56
The Digital Port	SV2AWG Freeware	KB7NO	DEC 58

DX

Build a Half-Square DX Antenna	As simple as they come	KG8AN	MAY 48

Interference

Mobile

Modifications

New Products (by manufacturer)

MFJ Enterprises, Inc.	MFJ-949E AirCore™ antenna tuner	Staff	APR 86
MFJ Enterprises, Inc.	MFJ-9606 FM Communicator™	Staff	NOV 80
MFJ Enterprises, Inc.	MFJ-1026 Noise Canceler	Staff	AUG 63
MFJ Enterprises, Inc.	MFJ-1721 2m UltraLite antenna	Staff	SEP 39
MFJ Enterprises, Inc.	*Ferromagnetic-Core Design ...*	DeMaw	MAY 83
MFJ Publishing	*Antennas and Transmission Lines*	Kuecken	MAR 50
Milestone Technologies	Island Memory Keyer	Staff	JUN 80
Mouser Electronics	New catalog	Staff	FEB 84
Mouser Electronics	Web site features catalog	Staff	NOV 80
National Radio Club	*AM Radio Log,* 17th ed.	Staff	APR 86
NCG Company	Comet CYA-240 dual-band yagi	Staff	DEC 72
NCG Company	SBB-1/SBB-1NMO 2m mobile ant.	Staff	OCT 48
Nemal Electronics International	Multicore camera cables	Staff	AUG 63
Nemal Electronics International	NE9395 Coaxial adapter	Staff	SEP 39
Old West Graphics	Graphic callsign mousepads	Staff	NOV 80
OFS WeatherFAX	PCMCIA VHF satellite receiver	Staff	JUN 80
Paktek, Inc.	ProTotes	Staff	JUN 80
Palomar Engineers	PFS-1 Field Strength Meter	Staff	JAN 84
Pauldon Associates	PD-440NA/NB ATV modulator	Staff	JUN 80
P.C. Electronics	TX33 1W Transmitter	Staff	JAN 84
QST	1970–1994 *QST* on CD-ROM	Staff	JAN 85
Radio Club Guide	*Radio Hobby Clubs Pocket Guide*	Staff	JAN 85
Radio Shack	1997 edition of *Answers* catalog	Staff	JAN 85
RF Connectors	7/16 DIN connectors	Staff	JUL 63
RF Connectors	BNC, N, and UHF connectors	Staff	JUN 80
RF Connectors	RFA-4015 "Porta-Strip"	Staff	MAR 50
RF Neulink	Digital Paging Transmitter	Staff	SEP 39
RF Neulink	Skyline-RTU VHF transceiver	Staff	APR 86
SESCOM	1997 MI-series Audio Xfmr cat.	Staff	MAR 50
Shack Attack	1997 catalog	Staff	JUN 80
SIGTEK	ST-108 Filter Demod	Staff	MAY 83
SSC	Wefax for Windows™	Staff	NOV 80
Svetlana Electron Devices, Inc.	3CX6000A7/YU148 power triode	Staff	SEP 39
Svetlana Electron Devices, Inc.	EF86/6267 audio small-sig pentode	Staff	APR 86
Tripp Lite	Version 9.0 PowerAlert Plus UPS	Staff	FEB 84
TrueTime, Inc.	TimeLink TL-3 real-time clock	Staff	JAN 84
WASSCO	Stereoscopic Microscope	Staff	FEB 84
WASSCO	New catalog	Staff	MAR 69
Xtal Set Society	*Crystal Set Projects*	Staff	SEP 39

Packet

A Baycom-Style HF PSK Modem	Build a packet modem from scratch	VK4AOC, VK4TN	NOV 46
APRS Network Guidelines	20 tips for increasing efficiency	W9IF	OCT 19
Reviewing the Packet Scene:	UK 1996	G3LDI	MAY 40
The Digital Port	Your Local PBBS	KB7NO	MAY 56
The Digital Port	BayPac™ portable helps diagnose	KB7NO	OCT 62
The Digital Port	Worldwide contacts	KB7NO	NOV 55

Power

Are You Ready to Recharge?	bq2903 charger chip	N4UAU	MAR 40
A Positive and Negative Power Supply	Simple one-evening project	KB4ZGC	JAN 31
In Search of Higher Power	And safe connection	W6YBT	FEB 70
NiCd Health Maintenance System	Get maximum life out of NiCds	N4UAU	JUN 35
Rechargeable Batteries	The bottom line	NZ9E	JAN 28
The Gel Cell Storage Battery	Great little power supply	KB4ZGC	FEB 41

QRP

Above & Beyond	QRP microwave rigs	WB6IGP	OCT 52
Bicycles Across Switzerland	QRPing by bicycle is a blast	NØBF	JUL 47
QRP	Electronic Keyers	WB8VGE	JAN 63
QRP	Miscellaneous	WB8VGE	FEB 61
QRP	Feedline	WB8VGE	MAR 84
QRP	Dayton	WB8VGE	APR 60
QRP	Ten-minute ID timer	WB8VGE	MAY 86
QRP	Low Power Operation	WB8VGE	JUN 62
QRP	Ni-MH batteries	WB8VGE	JUL 54

QRP	"Five Days In May" QRP forum	WB8VGE	AUG 51
QRP	Random length wire antenna	WB8VGE	SEP 52
QRP	Power control module	WB8VGE	OCT 80
QRP	Brief look at the Century 21	WB8VGE	NOV 54
QRP	Modifications	WB8YGE	DEC 80
QRP T-R Circuit	Simple and versatile	WUØL	FEB 67
Small Loop Design for HF QRP	A practical approach	WV8R	APR 42
Which Band's Best for QRP?	Some are better than others	W4LJD	OCT 44

Radio Direction Finding, Fox Hunts

Homing In	Foxhunting jamboree	KØOV	JAN 57
Homing In	Build a multiple polarization quad	KØOV	FEB 56
Homing In	Testing N6BG's PicCon	KØOV	MAR 58
Homing In	On-foot radio orienteering	KØOV	APR 76
Homing In	Dopplers	KØOV	MAY 80
Homing In	Start with the right tools	KØOV	JUN 71
Homing In	Follow the fluxgate	KØOV	JUL 52
Homing In	Build the NorthScope	KØOV	AUG 57
Homing In	Low-cost monitor for NorthScope	KØOV	SEP 84
Homing In	Dopplers; signal bouncing	KØOV	OCT 58
Homing In	Deceptions	KØOV	NOV 76
Homing In	RDF Gear	KØOV	DEC 54

Repeaters

Free Repeater, Free HTs ...	Gearing up for company service	WA9PYH	AUG 10
Sumas Mountain High	Building a self-sufficient rptr. tower	VE7BID	FEB 30

Reviews (by manufacturer)

Agrelo Engineering	DFjr Doppler Direction Finder	KØOV	AUG 24
Cable X-Perts	G5RV Multiband Ant. Kit	NØBLX	APR 26
EMTECH	NW40 Transceiver Kit	AC4HF	NOV 41
Hamtronics	TA-51 Exciter Kit	WB9RRT	APR 40
Hamtronics	TD-5 Tone Encoder/Decoder Kit	WB9RRT	DEC 42
Hamtronics	RWX Storm Watch Rcvr	WA3WGV	FEB 34
ICOM	IC-R100 Comm. Receiver	K4CHE	JUN 45
Jackson Harbor Press	WB9KZY Island Keyer Kit	AAØXI/VK5FN	MAY 52
LDG Electronics	QRP Auto Tuner Kit	AC4HF	JUN 42
LDG Electronics	AT-11 Automatic Antenna Tuner	AAØXI/VK5FN	JUL 38
MFJ	MFJ-969 Deluxe Versa Tuner II	NØBLX	SEP 37
MultiFax	AM/FM WEFAX Demodulator	WB9RRT	JAN 40
Northern Lights Software	Nova for Windows™	KAØSNL	MAR 27
Pacific Sierra Research Corp.	HFx Propagation software	N1VXW	JAN 35
Ramsey	DN-1 Dr. NiCad battery charger	WUØL	JUL 24
Small Wonder Labs	GM-30 Transceiver Kit	AC4HF	OCT 38
Sony	ICF-SW100S Comm. receiver	AH2AR/5	AUG 28
Standard	C108A HT	WA3WGV	JUN 48
Ten-Tec	1340 QRP Transc. kit	WB8VGE	SEP 41
Ten-Tec	T-Kit 1208 6m Transverter	NØBLX	FEB 44
Timewave Technology	DSP-599ZX DSP	WA9PYH	MAY 30
Wilderness Radio	KC2 Transcv. Accessory Kit	W3DX	MAR 33
Yaesu	FT-1000MP Transceiver	N1VXW	MAY 50
Yaesu	FT-727R HT Vintage Review	NV7K/6	JUL 68

Reviews (by product)

AM/FM WEFAX Demodulator	MultiFax	WB9RRT	JAN 40
AT-11 Automatic Antenna Tuner	LDG Electronics	AAØXI/VK5FN	JUL 38
C108A HT	Standard	WA3WGV	JUN 48
DFjr Doppler Direction Finder	Agrelo	KØOV	AUG 24
DN-1 Dr. NiCad Rapid Charger	Ramsey	WUØL	JUL 24
DSP-599ZX DSP	Timewave Technology	WA9PYH	MAY 30
GM-30 Transceiver Kit	Small Wonder Labs	AC4HF	OCT 38
FT-727R Dual Bander	Yaesu (Vintage Review)	NV7K/6	JUL 68
FT-1000MP Transceiver	Yaesu	N1VXW	MAY 50
G5RV Multiband Ant. Kit	Cable X-Perts	NØBLX	APR 26

HFx Propagation software	Pacific Sierra Research Corp.	N1VXW	JAN 35
ICF-SW100S Micro-sized Comm. receiver	Sony	AH2AR/5	AUG 28
IC-R100 Communications Receiver	ICOM	K4CHE	JUN 45
KC2 Transceiver Accessory Kit	Wilderness Radio	W3DX	MAR 33
MFJ-969 Deluxe Versa Tuner II	MFJ	NØBLX	SEP 37
NW40 Transceiver Kit	EMTECH	AC4HF	NOV 41
Nova for Windows	Northern Lights Software	KAØSNL	MAR 27
QRP Automatic Antenna Tuner Kit	LDG	AC4HF	JUN 42
RWX Storm Watch Rcvr	Hamtronics	WA3WGV	FEB 34
TA-51 Exciter Kit	Hamtronics	WB9RRT	APR 40
TD-5 Tone Encoder/Decoder Kit	Hamtronics	WB9RRT	DEC 42
Ten-Tec 1340 QRP xcvr kit	Ten-Tec	WB8VGE	SEP 41
T-Kit 1208 6m Transverter	Ten-Tec	WA3WGV	FEB 34
WB9KZY Island Keyer Kit	Jackson Harbor Press	AAØXI/VK5FN	MAY 52

RTTY

RTTY Loop	Ham radio shareware on-line	WA3AJR	JAN 48
RTTY Loop	Miscellaneous	WA3AJR	FEB 46
RTTY Loop	AEA demise	WA3AJR	MAR 79
RTTY Loop	New technology	WA3AJR	APR 82
RTTY Loop	Letters	WA3AJR	MAY 72
RTTY Loop	Radio Guide, AEA update	WA3AJR	JUN 78
RTTY Loop	Letters	WA3AJR	JUL 74
RTTY Loop	RTTY 2.0, RADIOCRAFT	WA3AJR	AUG 85
RTTY Loop	Getting weather info	WA3AJR	SEP 59
RTTY Loop	RTTY Picture Contest	WA3AJR	OCT 54
RTTY Loop	GreenKeys Internet mailing list	WA3AJR	NOV 62
RTTY Loop	V20 chip, gift time, lore	WA3AJR	DEC 62

Satellite Operation, EME, Space

Communications & Live ATV Via Outer Space	Real-life use of ham satellites	W8ZCF, W9NTP	MAR 25
Getting Ready for Phase 3D	Start now to be prepared	WA5ZIB	MAR 10
Hamsats	OSCARS, Phase 3-D	WA5ZIB	JAN 52
Hamsats	AMSAT Annual Meeting	WA5ZIB	FEB 48
Hamsats	Satellites Made Easy	WA5ZIB	MAR 60
Hamsats	New Russian in the sky	W5ACM	JUN 58
Hamsats	SSTV, SAREX, *Mir*	W5ACM	JUL 56
Hamsats	Going mobile, the right equipment	W5ACM	AUG 54
Hamsats	P3G to P3D	W5ACM	SEP 60
Hamsats	Field Day without OSCAR 13 ...	W5ACM	NOV 77
Hamsats	*Mir*	W5ACM	DEC 60
The Whole World In the Palm of Your Hand	Navstar Global Positioning System	NZ9E	MAR 18

Software

Amateur Radio and Linux	Software home-brewing	W9IF	FEB 10
Carr's Corner	More on ham software	K4IPV	MAY 59
Carr's Corner	Builder's potpourri	K4IPV	NOV 50

Test Equipment

Make a Ten-to-One Probe	Easier troubleshooting	AD4UA	JUN 67
RF Voltage and Power Meter	Easy-to-build instrument	WI5W	NOV 67
Simple Signal Injector/Tracer	Troubleshooting made easy	W4LJD	OCT 23
Variable Current Load Bank	Test power supply parameters	W7DE	NOV 71

Tutorial

APRS Network Guidelines	20 tips for increasing efficiency	W9IF	OCT 19
Ask Kaboom	RF	KB1UM	FEB 54
Ask Kaboom	Video Signals	KB1UM	MAR 77
Ask Kaboom	More TV	KB1UM	APR 56
Ask Kaboom	Color me video!	KB1UM	MAY 76
Ask Kaboom	Color quagmire	KB1UM	JUN 60
Ask Kaboom	Video recording	KB1UM	AUG 60
Ask Kaboom	Color it successful!	KB1UM	OCT 60
Build Your First Kit!	Just follow one ham's simple advice	NØBLX	DEC 24

Carr's Corner	Wanna Make History?	K4IPV	JAN 50
Carr's Corner	Better software design?	K4IPV	FEB 47
Carr's Corner	Solar effects on propagation	K4IPV	MAR 76
Carr's Corner	Science fairs	K4IPV	APR 62
Carr's Corner	Phased verticals	K4IPV	JUN 69
Carr's Corner	Antenna erection guidelines	K4IPV	JUL 76
Carr's Corner	Software, Radio Astronomy	K4IPV	AUG 50
Carr's Corner	Find ant. dimensions by scaling	K4IPV	OCT 50
Carr's Corner	Digging DX Out of the Noise	K4IPV	DEC 74
Communications Simplified, Part 13	Transmission lines	K2OAW	JAN 64
Communications Simplified, Part 14	More transmission lines	K2OAW	FEB 64
Communications Simplified, Part 15	Antenna Basics	K2OAW	MAR 64
Communications Simplified, Part 16	More Antennas	K2OAW	APR 64
Communications Simplified, Part 17	Optical Fibers	K2OAW	MAY 64
Communications Simplified, Part 18	Connectors and splices	K2OAW	JUN 64
Communications Simplified, Part 19	Multiplexing and digital data	K2OAW	JUL 64
Communications Simplified, Part 20	Signal sampling	K2OAW	AUG 64
Communications Simplified, Part 21	POTS, Modems	K2OAW	SEP 64
Communications Simplified, Part 22	Your telephone company	K2OAW	OCT 64
Communications Simplified, Part 23	Conclusion	K2OAW	NOV 81
Figuring RF Exposure	Avoid potential hazards	W6YBT	AUG 16
For Computer Illiterates Only	Take a trip through your PC	W6BNB	OCT 84
Getting a Taste of VHF	Test drive the bands	VA3ACK	JUN 10
How to Silverplate RF Tank Circuits	Simple and inexpensive process	WB2CQM	DEC 18
Oscillator Basics, Part 1	Things every ham should know	W6WTU	AUG 70
Oscillator Circuits, Part 2	Descriptions, circuits 1 through 12	W6WTU	SEP 71
Oscillator Basics, Part 3	Frequency synthesizers and you	W6WTU	OCT 69
Rechargeable Batteries	The bottom line	NZ9E	JAN 28
Surface Mount Devices	Everything you should know	W6WTU	OCT 10
The ABCs of HF Antennas	Beginning hams, take heart!	NZ9E	SEP 74
TV/VCR Tuner Applications	Part 1	W6WTU	APR 18
TV/VCR Tuner Applications	Part 2	W6WTU	MAY 36
TV/VCR Tuner Applications	Part 3	W6WTU	JUN 30

Updates

440 Yagi Link Antennas	OCT 1996 issue	KAØNAN	JAN 87
A Low Current Light	NOV 1996 issue	KB4ZGC	JAN 85
Audio Filter Alignment Generator	DEC 1996 issue	KB4ZGC	FEB 83
Build an Audio Multiplexer	MAY 1997 issue	KB8XI	JUN 53
Build the MagGlass	JUN 1997 issue	AH2AR/5	AUG 49
Build the Turbo Digi-Sniffer	FEB 1997 issue	AH2AR/5	JUN 53
Build This Receiver Preamplifier	JAN 1997 issue	W9QHV	MAR 88
Elegant Rotating Revisited	FEB 1997 issue	W6ZZB	MAY 88
Enhanced Automatic Voltage Controller	JAN 1997 issue	N4UAU	FEB 83
Enhanced Automatic Voltage Controller	JAN 1997 issue	N4UAU	MAR 88
Ham Help—Rusty Auxier address	FEB 1997 issue	Staff	MAY 88
Ham to Ham	APR 1997 issue	NZ9E	JUN 53
Homing In	JUL 1997 issue	KØOV	AUG 49
May Table of Contents	MAY 1997 issue	Staff	JUN 53
Reviewing the Packet Scene	MAY 1997 issue	G3LDI	JUN 53
TV/VCR Tuner Applications, Part 2	MAY 1997 issue	W6WTU	JUN 53

VHF/UHF

Above & Beyond	1296 MHz Amp./Mixer	WB6IGP	JAN 59
Above & Beyond	Microwave stripline retuning	WB6IGP	FEB 58
Above & Beyond	Antennas	WB6IGP	MAR 56
Above & Beyond	VHF/UHF beams	WB6IGP	APR 79
Above & Beyond	Mods to MFJ-259/219	WB6IGP	MAY 74
Above & Beyond	Silk-screening a microwave ant.	WB6IGP	JUN 54
Above & Beyond	Making silk-screened PC boards	WB6IGP	JUL 57
Above & Beyond	ARRL 10GHz contest	WB6IGP	AUG 78
Above & Beyond	Surplus coax switch	WB6IGP	SEP 82
Above & Beyond	QRP microwave rigs	WB6IGP	OCT 52
Above & Beyond	QRP transceivers for microwave	WB6IGP	NOV 52
Above & Beyond	Stocking the junk box	WB6IGP	DEC 50
Getting a Taste of VHF	Test drive the bands	VA3ACK	JUN 10

Number 49 on your Feedback card

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the April issue, we should receive it by January 31. Provide a clear, concise summary of the essential details about your Special Event.

JAN 10

LOVELAND, CO The Northern Colorado ARC will host their "Superfest" 9 a.m.–3 p.m. at the Larimer County Fairgrounds, 700 Railroad Avenue. VE exams, commercial exhibits, computer and radio goodies, more. Reserve tables from *Jeanene Gage NØYHY, (970) 351-7327*. For general info, call *(970) 352-5304*. Talk-in is on 145.115(-) 100 Hz, or 146.85(-).

JAN 17

HAMMOND, LA The Southeast Louisiana ARC, Inc., will hold the SELARC Hamfest at Southeastern Louisiana University, University Center, upper level. There will be adequate display space under climate controlled conditions, with multiple meeting rooms and excellent parking. Inclined ramps to the exhibition level will ensure easy loading and unloading. All commercial tables, $20. Swap tables, $10. No admission fee. This event will not allow flea market or craft items unless they are amateur radio or computer-related. Contact *SELARC, Inc. (Hamfest 98), P.O. Box 1324, Hammond LA 70404-1324.*

ST. JOSEPH, MO The 8th annual Northwest Missouri Winter Hamfest will be held on Jan. 17th, 1998, 9 a.m.–4 p.m., at the Ramada Inn in St. Joseph MO, with special room rates for hamfest participants. The event is being co-sponsored by the Missouri Valley ARC, Green-Hills ARC and Ray-Clay ARC. The motel is located at I-29 and Frederick Ave. (exit 47 on I-29). Talk-in on 146.85 and 444.925. VE exams, major exhibitors, and flea market all indoors. Free parking. Advance tickets $2 ea. or 3/$5; at the door $3 ea. or 2/$5. Pre-reg. requests received after Jan. 8th will be held at the door. Swap tables $9 ea. first 2 tables. Commercial exhibitors are welcome. Write for details to *Northwest Missouri Winter Hamfest, c/o Gaylen Pearson WBØW, 1210 Midyett Road, St. Joseph MO 64506.*

JAN 18

RICHMOND, VA The Richmond Amateur Telecommunications Society (RATS) will hold "Frostfest 98" 8:30 a.m.–3:30 p.m. at the Showplace, 3000 Mechanicsville Tpke. I-95 exit 75 to I-64 east, then exit 192 (Rt. 360 East), go 1/2 mi. on left. Forums, flea market, handicapped accessible. Talk-in on 146.88. Admission $6. Contact *Todd or Amy McCoy, (804) 330-3165*, or write *P.O. Box 35021, Richmond VA 23235*. For info, call *(804) 739-2269, ext 3378*. Check the Internet at [http://frostfest.rats.net].

YONKERS, NY The Metro 70 cm Network will hold an Electronic Flea Market, 9 a.m.–3 p.m., at Lincoln High School, Kneeland Ave., Yonkers NY. Free parking. Indoor flea market. No tailgating. VE exams. New and used equipment for CB operators, amateur radio operators, commercial two-way radios, computers, stereo buffs, televisions, telephones, electronic parts and kits, and much more, will be on sale. Admission is $6 for adults; children under 12, accompanied by an adult, are admitted free. For information, or to register as a vendor, call *Otto Supliski WB2SLQ at (914) 969-1053*. Talk-in on 449.425 MHz pi 156.7; 223.760 MHz pi 67.0; 146.910 MHz; and 443.350 MHz pi 156.7. Mail paid reservations to *Metro 70 CM Network, 53 Hayward St., Yonkers NY 10704.*

JAN 24

GALLATIN, TN The Tennessee Valley Amateur Radio Network will hold its 8th annual Hamfest and Computer Show at the Gallatin Civic Center. Setup Fri. 5–9 p.m., Sat. 5–8 p.m. Open Sat., 8 a.m.–2 p.m. Tables $10. Adm. $5. XYLs and under 16 free. Talk-in on 147.90/.30 T 114.8. Food available. Free parking, handicapped accessible. VE exams by pre-registration only. Send 610, copy of license or certificate of successful completion, and an SASE to *Ronnie Gilley, 512 Hillside Dr., Gallatin TN 37066.* For hamfest info, contact *Bill Ferrell, 1253 Woodvale Dr., Gallatin TN 37066;* or *phone (615) 451-5992* and leave a message.

JAN 25

DOVER, OH The Tusco ARC Hamfest will be held 8 a.m.–1 p.m. at Ohio National Guard Armory, 2800 North Wooster Ave., Dover OH. Admission $2 at the door. Dealers admitted at no charge. Tables $8 each. Bring your own extension cords. Reservation deadline is Jan. 11th. Remember to include an SASE. Setup at 6 a.m. ARES forum. Remit to *Tusco ARC, c/o Howard Blind KD8KF, 6288 Echo Lake Road NE, New Philadelphia OH 44663.*

VILLA PARK, IL The Wheaton Community Radio Amateurs will hold their 31st annual mid-winter Hamfest on Super Bowl Sunday, Jan. 25th, 1998. It will be held at the Odeum Exposition Center, 8 a.m.–2 p.m. Tickets are $6 in advance (with four prize stubs), or $8 at the door (with one prize stub). Advance tickets may be purchased by sending a business-size SASE to *WCRA, P.O. Box QSL, Wheaton IL 60189.* Free off-site parking and bus service is included in the ticket price. All flea market tables by reservation; please call *(630) 545-9950*. For commercial area info, call *(630) 545-9950;* or fax *(630) 629-7098*. Talk-in on 145.390(-). VE exams will be held on-site. Take a look at the Web site at [www.w9ccu.org].

JAN 31

ALBUQUERQUE, NM The Del Norte High School parking lot, at the corners of Montgomery and San Mateo Blvds., is the location for the Albuquerque Winter Tailgate Swapfest. This event will be open 8 a.m.–2 p.m. (depending on the weather), and admission is free. For more info, please contact *Tom Ellis K5TEE, 912 Lomas Ct. NE, Albuquerque NM 87112-5515; phone (505) 291-8122.*

LOCKPORT, NY The Lockport Amateur Radio Assn. will hold its 37th annual Winter Auction at 3 p.m. at the Niagara County Cooperative Extension, Lake Ave. (Rt. 78), 1/4 mile north of the city of Lockport. Admission is $4. Talk-in on 146.82(-) W2RUI rptr. Contact Floyd King WA2ZVL, (716) 434-1533. See the Web page at [http://www.localnet.com/~ae2t/lara/auction.html].

FEB 2

PHOENIX, AZ An amateur radio equipment auction will be held by the West Valley ARC at St. Clement of Rome Catholic Church Social Hall, 15800 Del Webb Blvd., Sun City AZ. Free admission. The club keeps 10% on equipment sales. Talk-in on 147.30+. Contact *George N7JSA at (602) 933-0854, or E-mail [watgl@juno.com].*

FEB 8

LATROBE, PA The Chestnut Ridge ARC Hamfest/Computer Show will be held 8 a.m.–3 p.m. at the American Legion, 1811 Ligonier Street in Latrobe. Take Route 30 to Route 982 North. Follow signs. Talk-in on 145.15(-) K3JDU rptr. Send payments to *CRARC, Box 175, Loyalhanna PA 15661-0175.*

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds in Mansfield, starting at 7 a.m. Tickets $4 in advance, $5 at the door. Tables $9 in advance, $12 at the door, if available. Reservation deadline is Jan. 15th. Talk-in on 146.34/.94 W8WE. For info, advance tickets/tables, send SASE to *Pat Ackerman N8YOB, 63 N. Illinois Ave., Mansfield OH 44905;* or phone *(419) 589-7133 after 6 p.m. EST.*

FEB 21–22

CINCINNATI, OH The 17th annual Great Lakes Division and Computer Convention (formerly Cincinnati ARRL 1998), will be held at Cincinnati Gardens and

Continued on page 81

Number 50 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
955 Manchester Avenue SW
North Lawrence OH 44666
[prosolar@sssnet.com]

It's hard to find a low-power enthusiast who has not at one time either owned or operated a Heathkit HW-8. This rig is a classic. I don't know right off how many HW-8s Heath sold, but it had to be many thousands. The HW-8 is still sought after, though the Heathkit company has long retired from the kit business.

Having said that, let's look at some of the common problems you may encounter if you're a newcomer to the HW-8.

Do the VFO tango

The HW-8 uses a simple VFO. The VFO is controlled by a variable capacitor mounted in the center of the PC board. A vernier drive couples the VFO's shaft to the main tuning knob. A stock HW-8 does not have RIT built in.

There are three basic problems with the HW-8 VFO: linearity, calibration, and broken or damaged VFO capacitor plates. Let's take the broken VFO capacitor plates first because the capacitor must be in good condition before we can attempt to adjust the VFO.

Like most variable capacitors, the one used in the HW-8 has its rotor plates press fit into the movable shaft. Turning the main tuning knob, from stop to stop, causes the rotor to be either fully meshed or fully unmeshed. To keep the rotor plates from shorting out against each other, small separators are used. The only mechanical stops are the rotor plates themselves. If you try to turn past these stops, two things happen. One, the separators break, and two, one or more of the rotor's plates come out of the shaft. So, if you run the main tuning capacitor past its stop, and keep on cranking, you'll ruin the VFO capacitor. Now you're probably thinking, "What a half-assed design that is." Well, to be fair to Heath, it's not really that bad. For you see, the vernier drive is supposed to prevent damage to the VFO capacitor by slipping at the end of travel.

But the HW-8 is heading on 25 years old. Most of the grease inside the vernier drive has long since dried out. With no grease (or very little), the drive now has too much friction and will allow you to rip out the guts of the VFO capacitor.

Fixing the damage

The best fix would be to install a new VFO capacitor. However, as far as I know, there are no replacement parts left. I doubt Heathkit had the VFO custom made, so it's a good bet it's a standard part—somewhere! But where? I don't have a clue.

You can repair the capacitor, however, although forget about setting the VFO for linearity from one end to the other. And to be sure, the VFO will no longer be accurate—but the fix will allow you to put the HW-8 back on the air.

First, remove the main tuning knob and the vernier drive. You'll need to completely strip the HW-8 of its front panel. You'll need to remove the plastic VFO dial. Use caution, as this dial will be fragile. Over time, the plastic becomes brittle.

The drive is fastened to the VFO shaft with a set screw. There are two small screws holding the vernier drive to the chassis. Remove these and slide the vernier drive off the VFO shaft.

Disassemble the vernier drive by unscrewing the part with the flanges from the smaller shaft end. Look for a spine nut on the drive. You'll need a very small screwdriver to back out the nut. When the drive is apart, you'll see several ball bearings and an internal flange. This flange rides on the bearings.

Now, clean out any old grease you see. Apply a small amount of new grease (I use electrical grease in a small squeeze tube available from Mouser™ or Digi-Key™). Don't overdo the greasing. Too much is worse than too little!

Reassemble the drive. You can try out the drive by holding one of the ears of the larger end in a small vise while turning the shaft end with your fingers. The output side should move, but at a much slower rate than the input side.

Stop the output side while still turning the input. The output shaft should slip with a slight amount of drag. If you're happy with the results, wipe any excess grease from the vernier and set it aside.

Fixing the capacitor

You need to remove the VFO capacitor from the rig. With the capacitor removed, carefully inspect the rotor plates for damage. A loose plate is one thing; a damaged plate is an entirely different matter. If you're lucky, maybe one or two plates have become loose.

With very fine needlenose pliers or a tweezers, grab the loose plate at its bottom. If you try to push the plate in from the top, you'll buckle it! The idea is to hold the plate as close to the point of entry of the shaft as possible. This will prevent the plate from distorting. It's a good idea to hold the capacitor's body in a small vise so you can have both hands free.

Generally, you don't need to force the plates back into their slots. They go in kinda easy.

It should also be common sense to everyone, but use caution while working on the loose plates. The more mangled the plates, the more trouble you'll have later on.

The plates are held in the shaft by friction. But once they are forced out (by running them into the stops) they won't stay in after you replace them. The fix is kinda radical. Glue 'em in! I've used two-part epoxy glue to hold the plates in. From the QRP-L list, BAH uses BAH with good results.

It's almost impossible to put the dislodged plates in straight, so I use some cardboard to hold the plates in their correct position until the epoxy sets. The idea here is to allow the cardboard to hold the plates straight until the epoxy sets, but not to glue the cardboard in by mistake!

Be sure to keep the epoxy away from the bearings on the capacitor. Use *only* enough epoxy to hold the plates. Too much will cause damage to the capacitor's shaft.

Allow plenty of time for the epoxy to set up. Don't rush the job. Most epoxy glues require at least 24 hours of cure time.

Putting everything back together

With the glue cured, rotate the capacitor's plates and be sure that none of the movable plates hit the stationary plates. Use your multimeter, set on continuity, to check for any shorts between the plates while you slowly rotate the capacitor through its range. The plates should be as straight as possible. If you've been careful, you should have a working capacitor once more. Reassemble the capacitor and drive once more into the rig.

It's a good bet the VFO will be way out of whack. The best place to start is by coupling a frequency counter to the output of the VFO—a great place to sneak a signal from L9. A few turns of hookup wire wrapped around L9's shield will work. If you want a more direct connection, place your counter's probe on the emitter lead of Q3. Transistor Q3 is the emitter follower for the VFO.

Number 51 on your Feedback card

THE DIGITAL PORT

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

Innovative packet programs and SSTV

Several readers have asked whether the BayPac™ BP-2M modem will send and receive slow scan television (SSTV). The answer is simply ... yes. How to do it is, as in many of our computer encounters, a little more complex—there's a definite learning curve.

When I purchased the BP-2M, several pieces of software were included: The BayCom DOS-based software for packet, HamComm 3.1, and JVFAX. I must admit I had not given much thought to using a FAX program and so I didn't load the JVFAX program until the questions came.

Being unfamiliar with the program's capabilities, I checked some listings for working SSTV with a modem and JVFAX popped up in several places along with other programs professing to do the job. So I loaded the program, which is another DOS one, not intended to run under Windows™.

There is a configuration procedure to follow which asks for information that most of us either don't know or have forgotten about our computers. After exerting about all the forces of my patience, I got the information "pretty close." I tuned the radio to 14.230 and, sure enough, there were some strange warbles that sounded like I had struck gold.

Putting it to the test

In all the time I have been a ham, this was my first experience with SSTV, so this was a true test to see if the software was user-friendly. As the hams on frequency were discussing the images and how they had captured and edited them, I could sense an enthusiasm that instantly made me eager to see this thing work.

At first, it was necessary to go back and tweak the configuration. After about the third tweak, I got close enough to receive black and white images on my screen. After dancing in the street to celebrate my success, it was time to determine what it would take to capture the color that was certainly a part of these images.

As I mentioned, deciphering all the parameter requests had already been a test, but with the knowledge that it could be made to work, my energy was renewed. I got right in the middle of the process and it looked like I was headed the right way when a small disaster struck. The program crashed.

Photo A. A chicken in the radio? This is what Hank KH6DEH considers a typical Hawaiian scene. This image was received under less than best conditions and off the back of my beam. He had one of the stronger signals during the test period as the band was about to fold for the day.

I thought it was just one of those things where a reboot would bring the program back to normal. Not so. It would be necessary to reload the program. I had done it in.

Continued on page 52

The VFO operates from a frequency of 8.645 MHz to 8.895 MHz. In theory, you want the VFO to track from 8.895 to 8.645. You do this by adjusting L9 and C302B. Again, in theory, you run the VFO to the high end; adjust L9. Run the VFO to the low end and adjust C302B. You keep doing this until the VFO operates exactly from 8.895 to 8.645. In theory! A brand-new stock HW-8 may be able to pull this off, but one 20 years old never will. And if your VFO has been glued together, forget it!

If you can't seem to put the VFO back on frequency, try gently moving one or more rotor plates. It won't take much, so use a plastic probe and push on a plate while the counter is displaying the VFO output frequency.

It's best if you just plan on placing the VFO tracking to favor one end of the band. This is very important if you had to repair the VFO capacitor.

If you have picked up a used HW-8, with a damaged VFO, a few voltage tests in the VFO area would be a good idea. Without the VFO running, the HW-8 won't receive or transmit!

At the junction of ZD1 and R33 (with 12 volts applied to the rig and the power turned on) you should see 9.1 volts. The collector of Q3 will be at 12 volts while the base sits at 1.5 volts. The source lead of Q2 should be 1.15 volts. Remember that your readings could be off by as much as 20 percent and still be correct.

Since the HW-8 is a direct conversion design, a lot depends on the VFO. Even if you had to repair the VFO capacitor, all is not lost. This is an easy rig to fix. Next month, we'll look at some of the switching problems the HW-8 faces and a few of the most popular modifications you can do to this low-power workhorse.

This meant installing the program and going through the configuration from scratch. I should have kept notes ... a lesson in hindsight. It was the end of a relatively satisfying session and time to get away from the computer for a bit. As I sat back and thought about the dilemma, I remembered seeing other software available. If it was necessary to start over, perhaps it would be just as well to stretch my learning capacity and look at something new.

More choices

I went to an HF-FAX Web site I had bookmarked in Netscape™ [http://ourworld.compuserve.com/homepages/HFFAX/hf-fax.htm], and found a dozen or more DOS programs and (surprise!) several SSTV programs to run under Windows. I read the descriptions of the Windows-based programs and selected W95SSTV for download.

It's a healthy size, on the order of three megabytes, as would be expected for a Windows program. It's well worth the on-line time to download. When you install it, you get the feel of a finished professional Windows 95™ program. It simply takes care of itself. The configuration is intuitive and accomplished in a few minutes.

No modem!

Now here's the kicker. It does not require a modem or any such external hardware. You *do* need a sound card. A 32-bit Sound Blaster™ card is preferred. I am still using a 16-bit SB card and it works fairly well. Also it's recommended to have better definition than my 256-color display, but that, too, works okay for now.

The hookup is simple. Cable your audio from your radio to the line-in jack on the sound card and make a cable from the line-out to the modulator input terminal on the AFSK connector on your radio. The good part is there is a detailed explanation of what to do and watch for in the documentation that accompanies the program. I like that.

The cost of trying it out for yourself? The program is shareware. It works 100%, not crippled, except it only works with bitmap (BMP) images until registered. Registration is $50. The cables were nominal. Along with some used cable (most any cable will suffice for audio) I had already, it was necessary to invest in some new plugs. I was started in SSTV with color for less than $10! I *really* like that.

I'll pass along a little hint, though it is covered in the instructions. It applies to getting enough audio drive for a modem as well as the sound board. Audio output isn't the same from every jack on most radios. I find the drive from the Accessory Port on the ICOM 735 is insufficient for the task at hand.

Measuring with a digital voltmeter, the output is consistently under one volt AC. The output from the headphone jack, which of course varies with volume control setting, can be pushed as high as seven volts AC. You only need about two volts more or less and the system will start to make pictures on your monitor.

Go for smoke

With the cables in the right places, the system was ready for a test drive. The manual leads you through a relatively brief testing, setup and orientation. Then you're ready for the real thing.

It was the right time of day and a group of hams were gathered at the 14.230 SSTV watering hole. The first picture received was coming through in color, and I was still learning to operate the program, so part of the image was not displayed.

It didn't take long to get the hang of which button to click at what time and the program started receiving images automatically. As I mentioned, my monitor and sound board are considered inferior, but the images are still pretty good, considering.

For example, some of the scenic images sent on SSTV are far from the norm, as can be seen **in Photo A**. You will find quite a variety of scenes that are candidates for serious photo exhibits. Of interest is the fact that on the HF bands, you can receive images anywhere in the world that you can copy an audio signal reasonably well. That is because the audio signal is the medium into which the video is coded. That may be a poor choice of words, but the point is that this method is necessary to make the transmission possible within the width of the HF bands. By contrast, check the extreme bandwidths of commercial TV broadcasts.

I found, after a time, that the quality of the received images could be improved by adjusting the passband tuning on the ICOM 735. I also made attempts with the external audio filter but the help was barely perceptible. The best answer is probably a DSP system—another item on my wish list.

Will it transmit?

I captured and stored one of Hank KH6DEH's many scenic images and retransmitted it to see if this part of the system really worked. I had previously transmitted into a dummy load and it appeared to work, but I needed confirmation that there was a real picture going out into the airwaves. Hank assured me the picture came through "loud and clear."

Transmit and receive is accomplished from a screen in the W95SSTV program. There is a pop-up editor that allows you to insert your callsign and other information into the image. The spectral display is an effective tuning help and gives an idea of signal quality as well as the interference at hand.

W95SSTV is a winner

The installation and successful operation of the program was definitely one of the smoothest transitions from bottom-rung-of-the-ladder to nearly flawless operation. The program screen is intuitive, although there were a few minutes of delay while I made up for the parts of the documentation I had skimmed through a bit too rapidly.

Packet on a sound board

Now for another thought along these lines. There is a Web site on the Internet with a downloadable set of modules to accomplish packet using the sound board also. No modem, no TNC—it appears the wheel has been reinvented. It doesn't look nearly as easy as the W95SSTV, and it will be a while before most of us get it sorted out, but it certainly deserves a look-see. Point your browser at [www.ife.ee.ethz.ch/~sailer/pcf/].

In retrospect, it appears to me that the digital communications format will blossom with many software innovations that will be as remarkable as the TNC was in the 1980s. That was quite a breakthrough for ham radio. It made it possible for hams of modest means to participate in a worldwide digital network. There have been some gains in speed and efficiency, but ham radio is overdue when we compare the 1200-baud rate to the speeds landline file transfers are attaining.

Don't be surprised if ham radio, once again, leads the way to more efficient and affordable means of communication. Some of the greatest minds work to ascend mental mountains "because they are there." Ham radio is a great outlet for those minds.

Lest I forget to pass it along, a few of you have informed me that shielding was necessary for your BP-2M modem to radio cable. Both Zak VK6BMZ and Jeff N3EPS claimed problems were solved on HF as well as VHF. The tech at TigerTronics™ says this shouldn't be necessary when using the cable supplied with the modem. So take it for what it is worth—if it works for you, it must be right.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @ N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

Hams with class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Photo B. *It's a good day to be a ham! At least Howard Price KA2QPJ and Carole Perry WB2MGP think so. Photos by Charles Hargrove N2NOV.*

Mayor's proclamation for hams

The people who live in the borough of Staten Island, New York, consider themselves lucky to have a big number of amateur radio operators who are very civic-minded. There is a dedicated group of hams who belong to ARES headed up by my friend Charlie Hargrove N2NOV. They believe that their responsibility to Part 97 of the FCC Rules and Regulations is to provide "value to the public for emergency communications."

Our ARES group in Staten Island has provided communications for walk-a-thons, parades, floods, and the New York City Marathon. In September of 1997, Charlie was thrilled to get an E-mail message from Howard Price KA2QPJ, of the local ABC News affiliate, saying that he was able to get the ear of Mayor Giuliani's press secretary to have His Honor sign a proclamation for Amateur Radio Awareness Day (September 20th).

Within less than 24 hours of getting this message, Charlie had arranged for seven Staten Island ARES members to readjust their schedules to be able to attend the mayor's presentation to us at City Hall. I myself was proud to have been invited, and quickly arranged for a substitute teacher to cover my radio classes that day. My principal, Barbara Glasman, was delighted to see our school and its ham radio program represented at the proclamation ceremony.

There were 13 amateur radio operators in all from New York City who were present at the famous "blue room" of City Hall on the morning of September 19th. Pictures were taken, hands were shaken, and smiles were in abundance. Mayor Giuliani expressed his appreciation of the work that amateur radio volunteers do to help out the MOEM (Mayor's Office of Emergency Management). [As of this writing, by the way, the communications command station at the MOEM just received its custom callsign from the FCC: WC2OEM.]

Photo A. *Proudly displaying Mayor Giuliani's proclamation are, shown left to right: Jerry Cudmore K2JRC; Frank Katalenas N2UMC; Howard Price KA2QPJ; Matt Evans WA2UKM; Jerome Hauer, Director, OEM; Charles Hargrove N2NOV; Karen Hargrove N2ZYF; John Kiernan KE2UN; and Beverly Dyrack KA2OPQ.*

The Mayor then read from the proclamation to us:

"Whereas: More than 100 federally licensed amateur radio operators dedicate their time to support public and private agencies in times of crisis. Two organizations—The Radio Amateur Civil Emergency Service under the Mayor's Office of Emergency Management and the Amateur Radio Emergency Service, a volunteer arm of the American Radio Relay League—provide backup communications to government agencies and disaster relief in the event normal radio channels are disrupted or overloaded; and Whereas: Volunteers work around the clock, donating their skill, time and equipment to serve the public. Many of the volunteers are trained by the Red Cross in first aid, and all are specially trained to handle emergency messages and routine radio traffic under intense deadlines and conditions. These volunteers have recently worked during the TWA flight 800 disaster and for Red Cross shelters opened for safe havens during weather emergencies; and Whereas: Our city's vast and complex communications system is indebted to the many trained amateur radio volunteers who are efficient and dependable and lend a much-needed hand in times of crisis or disaster. They are an invaluable part of our city's communications network. Now therefore, I, Rudolph Giuliani, Mayor of The City of New York, in recognition of this important event, do hereby proclaim Saturday, September 20th, 1997 in The City of New York as 'Amateur Radio Awareness Day.'"

The Director in the mayor's office for MOEM is Jerome Hauer, who was also in attendance at the signing. The hams on hand for this exciting event were: Howard Price KA2QPJ, Jerry Cudmore K2JRC, Charles Hargrove N2NOV, Karen Hargrove N2ZYF, Arthur Booten N2ZRC, John Kiernan KE2UN, Matt Evans WA2UKM, Rich Dyrack K2LUQ, Beverly Dyrack KA2OPQ, Bill Butler N2BGR, Frank Katalenas N2UMC, Carole Perry W2MGP, and Scott Swanson N9SAT. 73

Number 54 on your Feedback card

Hamsats

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

Last year at this time the launch of Phase 3D, the largest and most advanced amateur radio satellite, was supposedly only a few months away. Circumstances have proven otherwise. The satellite has been structurally modified for greater than anticipated launch stresses, is heavier, and still has a few outstanding construction issues in search of resolution. Phase 3D was the primary topic of the 1997 AMSAT Annual Meeting and Space Symposium held in Toronto, Ontario, over the weekend of October 17th through the 20th.

The AMSAT annual meeting

Over 200 satellite enthusiasts went to Canada to hear the latest news about Phase 3D, listen to presentations on other hamsat topics, attend the AMSAT Board of Directors meeting, and tour the city of Toronto. AMSAT meetings are typically held wherever the local volunteers have the interest and infrastructure necessary to host the event. In 1996 we went to Tucson, Arizona. This year it was Toronto, and next year it will be Vicksburg, Mississippi.

The space symposium

Activities began in earnest on Friday morning at 8 a.m. Many attendees made it a point to arrive on Thursday to ensure they would miss nothing.

Chuck Duey KIØAG got things started with his presentation about mobile and portable operations via voice-mode satellites. Chuck has been active on several low-orbit satellites including Fuji-OSCARs 20 and 29, RS-10, and AMRAD-OSCAR-27. He uses the Arrow Antenna™ model 146/437-10 dual-band yagi with an integral low-power duplexer for two-meter and 70-cm activity. Using this antenna with a dual-band HT, Chuck managed several contacts on a single pass via A-O-27 from the Delta Hotel parking lot (**Photo A**) to augment his excellent talk.

Many stations have made short contacts via A-O-27 using only dual-band whip antennas on HTs, but the addition of a good yagi makes a marked difference. During Chuck's parking-lot demonstration, downlink signals on 70 cm were strong and the two-meter, three-watt output from Chuck's HT appreciated the additional uplink gain of the beam.

Most of Arrow's antennas are made from aluminum arrow shafts with threaded inserts for easy takedown, setup and portability. Plastic element tips are included for safety. The antennas are engineered for maximum gain and efficiency in the smallest practical size and lightest weight. Chuck's presentation and on-the-air demonstrations were quite a hit at the symposium.

Other talks on Friday morning included Ashley Rego of SPAR Aerospace describing the New Canada Arm designed for the International Space Station; an introduction to microwave work by Laura Halliday VE7LDH; Bdale Garbee's discussion on how the Internet and free software actually help AMSAT; WATOO™—new Internet access software for satellite tracking by Marc Normandeau, Jean-Marc Desbiens, Michel Barbeau, and Steve Bernier; and finally a discussion by Rich Moseson W2VU, explaining the use of the Weather Channel™ as a model of satellite technology for newcomers.

The Friday afternoon talks were dominated with software topics in addition to some solid hardware discussions by Ken Ernandes N2WWD and Fred Winter on a new EZ-SAT™ proposal and Dr. Robert E. Zee's presentation on the University of Toronto's astronomy microsatellite project.

Anthony Montiero AA2TX described an object-oriented approach to automatic radio tuning. John Hansen WAØPTV delineated the use of broadcast protocols on terrestrial links. While many groups around the country have considered the efficiency of the satellite-based, digital, 9600-baud broadcast protocol on the UoSATs and KITSATs, the software has not been openly available. Doug Quagliana KA2UPW showed the advantages of a simple BPSK (bi-phase shift keying) modulation system implemented with software and minimal hardware and John Melton GØORX went into his efforts to develop non-machine-specific software using Java™. Robert Hillman finished Friday's talks with his notes on the design of a space imaging processing system.

Friday evening provided a great opportunity to renew acquaintances and get into some late-night discussions and friendly arguments on technical and political hamsat topics.

***Photo A.** Chuck Duey KIØAG gave a talk on mobile and portable hamsat operation in addition to making several AMRAD-OSCAR-27 QSOs outside the convention hotel. Harry JA1ANG looks on.*

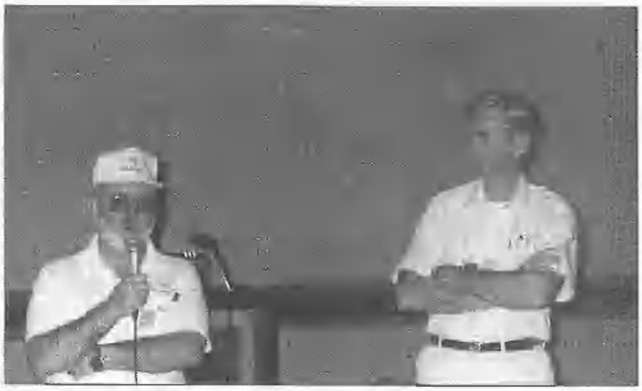


***Photo B.** Lou McFadin W5DID and Stan Wood WA4NFY provided a Phase 3D progress report at the 1997 AMSAT Space Symposium in Toronto, Ontario.*

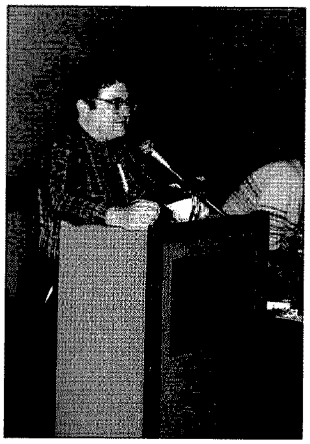


Photo C. Dan Schultz N8FGV presented a paper on digital voice modulation techniques for a future generation of hamsats.

Saturday

Activities on Saturday began promptly at 8 a.m. AMSAT President Bill Tynan provided opening remarks and a welcome. After the preliminaries were out of the way, the topic of interest, Phase 3D, was addressed. Bill told the audience about the difficulties AMSAT had been through, meeting the launch stress requirements from the European Space Agency for the *Ariane 502* flight scheduled for 1997. AMSAT could not make the structural modifications to Phase 3D and prepare all of the transponders, experiments and support equipment in time to match the ESA's launch agenda.

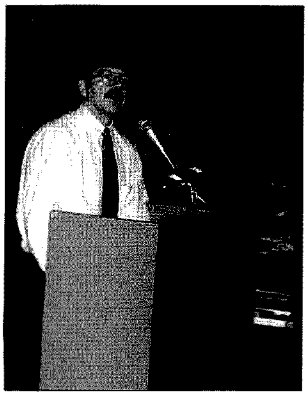


Photo D. Frank Bauer KA3HDO provided insight on the Amateur Radio gear for the new International Space Station.

AMSAT Payload Integration Manager Lou McFadin W5DID (**Photo B**), and AMSAT Vice President of Engineering Stan Wood WA4NFY joined Bill at the podium to detail the efforts at the AMSAT lab in Orlando, Florida, over the past year. Lou showed videotape documenting the many mechanical components needed to strengthen the structure of the satellite. Overhead slides were used to point out the high stress points that required work. Stan described many other activities at the lab in support of the project. During the year payloads from around the world were brought to Orlando for final integration and testing.

AMSAT Executive Vice President Keith Baker KB1SF brought the group up to date on the financial status of AMSAT North America. Until launch, expenses supporting the program will continue. While AMSAT is not currently tight for money, any significant delays or further surprises, like the projected launch stresses and required space frame modifications, will cause serious problems. Bill pointed out that talks with the ESA about another launch opportunity will not begin until the completion of the *Ariane 502* mission.

The Phase 3D presentation engaged a large segment of the morning. Other talks before lunch included the design and implementation of Internet-linked ground stations for the amateur satellite community by Chris Bond and Mark Maier; a Phase-4 "lite" proposal by Philip Chien KC4YER; a Phase 3D GPS receiver progress report by Bdale Garbee N3EUA; and finally a practical guide to Phase 3D operation on Mode L (1.2 GHz) and above by Ed Krome K9EK. Ed has provided many simple solutions to complex digital and microwave challenges over many years.

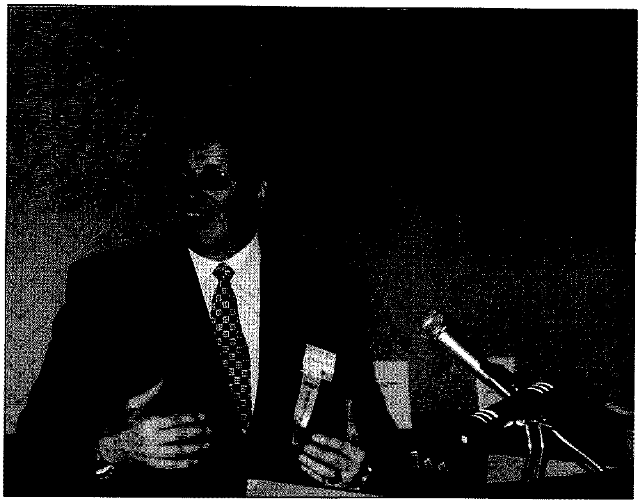


Photo E. Hans van de Groenendaal ZS5AKV, IARU Satellite Advisor and Member of the IARU Region 1 Executive Committee, provided an excellent speech at the AMSAT banquet on Saturday night.

During the symposium days, the Delta Hotel restaurant did an excellent job. Saturday lunch was no exception. Service was quick and the prices were reasonable. We were back in the meeting room on time for Dan Schultz's description of digital voice modulation techniques for a future generation of ham satellites (**Photo C**). Martin Davidoff K2UBC, author of *The Satellite Experimenter's Handbook*, followed with his thoughts on selecting orbits for LEO (low earth orbit) constellations and SSB/CW satellite communications. Ken Ernandes N2WWD continued the thread with his description of a candidate orbit for future AMSAT spacecraft.

AMSAT Vice President for Manned Space Activities Frank Bauer KA3HDO provided details on the amateur radio opportunities on board the future International Space Station (**Photo D**). The proposals for two feet of rack space dedicated to ham gear were accepted by NASA. Frank will be working with his recently-formed group of hams from participating countries to plan and build the equipment and antennas for the ISS.

Following the talks, an hour was allocated for the AMSAT General Meeting. All of the AMSAT officers and board members took the stage to provide information to the membership about their programs and projects. It was also an opportunity for the members to ask questions. The Phase 3D topic was good for a few more queries.

The official activities of the day ended with an excellent banquet; a talk about the future of amateur satellite frequency allocations by IARU Satellite Advisor Hans van de Groenendaal ZS5AKV (**Photo E**); plaque presentations by Bill Tynan and other AMSAT officers; and the

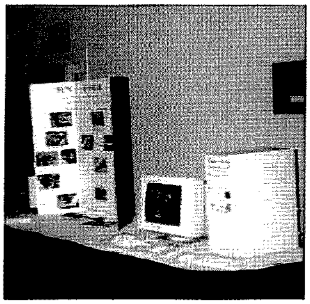


Photo F. One of the display demonstrations at the AMSAT Space Symposium.

Photo G. TAPR President Greg Jones WD5IVD (left), AMSAT President Bill Tynan W3XO (right) and others take a break at the AMSAT Space Symposium in Toronto, Ontario.

prize drawings. This year ICOM America™, Rosetta Laboratories™ of Australia, and Kenwood Canada™ provided the top prizes. The odds of winning were excellent, with over 100 other items ranging from a Kansas City Tracker Tuner™ to ESA T-shirts.

Sunday

AMSAT Vice President of Field Operations Barry Baines WD4ASW hosted an Area Coordinators' breakfast at 7:30 a.m. AMSAT currently has over 150 volunteer area coordinators who make presentations to ham clubs and offer assistance to those that would like to participate in hamsat activities. Barry's efforts to support the field volunteers has paid off. Many coordinators join the ranks every month to help promote this facet of amateur radio activity.

The remainder of Sunday morning was dominated by the IARU meeting. Satellite frequency coordination efforts were discussed in addition to many other topics. Debate was encouraged on preparation for WRC99, frequency allocations challenges from Africa, and the use of amateur satellites by third parties engaged in emergency communications.

While many symposium attendees took off for home on Sunday afternoon, the AMSAT Board of Directors meeting was just beginning. Bill Tynan's agenda set a tough pace. The Sunday session lasted till 10:30 p.m. An early start on Monday allowed an end by about 3:30 p.m. A transcript of the discussions and motions will be printed in an upcoming issue of *The AMSAT Journal*.

The Toronto volunteers did a fantastic job with the 1997 AMSAT Space Symposium and General Meeting. The Vicksburg, Mississippi, group will have a really hard act to follow. Perhaps by this time next year Phase 3D will finally be in orbit. The project, now seven years old, has been the most challenging one to date.

Note: You can find Arrow Antenna on the Internet at [http://Members.aol.com/Arrow146/index.html]. Their E-mail address is [Arrow146@aol.com]. The standard mail address is 1803 S. Greeley Hwy. #B, Cheyenne WY 82007. Their phone number is (307) 638-2369, and the FAX line is (307) 638-3521.

Number 56 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907
[pangen@compuserve.com]

Plan to plan

What do you do in an emergency? Naturally, that depends upon what type of emergency you're faced with. We teach our children to stop, drop, and roll if they ever catch their clothing on fire. It's a simple plan that can save a child's life. But what about the type of emergency you may be called upon to support as a ham radio operator? Do you have a plan for that? Many people assume that they will merely grab their handie-talkie, head to where the action is, and talk on the radio. In many cases, this is not the best idea.

A friend of mine used to always quote the "six P" rule, that "Poor Planning Produces Poor Performance." I know there are only five Ps—use your imagination for the sixth. If you have no idea what you're going to do in an emergency situation such as a natural disaster, you are counting much too heavily on luck and divine intervention.

Planning for emergencies and disasters is a tricky business, because by definition, a disaster or an emergency is unexpected. By the same token, a plan is a series of ideas which may be appropriate for a given situation. Most plans begin changing as soon as they are implemented. However, they do provide the skeletal structure, and a starting point.

The military has operational plans for virtually any possible conflict, and when an event occurs, the appropriate plan is retrieved and set into motion. Warfare has many of the aspects of a disaster, plus the added problem of the bad guys' army or navy trying to make things as difficult as possible.

There's a lesson to be learned here. In most cases, in the event of an emergency which would involve the use of the amateur radio community, a number of other organizations would be involved. These would include the police and fire departments, possibly the area Civil Defense authority (often called the Office of Emergency Preparedness or such), and relief agencies,

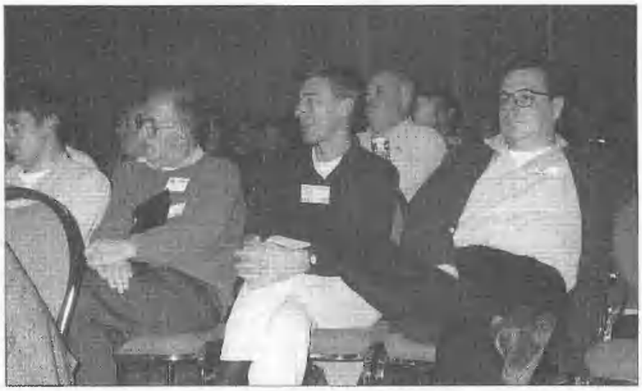


Photo H. Alberto Zagni I2KBD (center) of ITAMSAT and other members of AMSAT Italy attended the AMSAT Space Symposium and ARISS (Amateur Radio on the International Space Symposium) meetings.

such as the Red Cross. While some hams are deeply involved with these agencies on a regular basis, most do not perceive the need to get involved until a crisis occurs. We need to plan a little better.

Developing a plan can be as simple as using the old mantra of newspaper reporters, "Who, What, When, Where, and How?" The "Who?" question covers several categories. Ideally, the Emergency Coordinator and his or her primary assistants will cover key areas, such as the Civil Defense Office, the Red Cross office, and so forth. If these key people know their responsibilities, and have an existing relationship with the people they are going to be working with, you have a significant advantage. An experienced ham with these skills can determine what the served agency needs, and then assign other hams to appropriate duties to meet these needs. A cadre of experienced operators is the key to a successful operation.

"What?" can be defined as "What support will we be providing?" Traditionally, this has included providing inter-agency communications so that there is a direct and immediate link among groups which may not be able to communicate directly. The local police, for example, may not be able to communicate with the National Guard, so hams can provide that service. Another common need is for hams to provide communications at emergency shelters, or to provide communications for those conducting damage assessment.

"When?" may seem an easy one… "when the disaster strikes." Unfortunately, the time frame for providing communications often extends for days, or in some cases, longer. There is often a surplus of willing volunteers the day the disaster strikes, but it quickly dwindles as time passes. A good plan will include identifying those who may be available for longer periods, or determining some folks who should be held back so they can be involved on the third through fifth days, rather than using everybody on day one. Many people can get a day or two off from work for such activities, but if everyone uses up their time early on, it gets difficult later. If you have hams who are retired or have the freedom to determine their own schedules, these folks can be invaluable for the longer haul.

"Where?" is always difficult, because we never know where a disaster will strike. However, it is not as difficult as it would appear. In many cases, there will be people needed for damage assessment, shelter operations, etc. If a ham takes the time to train with a particular agency for a role, he or she is a natural for that particular type of location.

The Red Cross provides training in damage assessment and emergency shelter management. A ham can function both as a damage assessor or shelter manager and his or her own communicator if the training was completed.

Likewise, if a ham operator is a reservist, it would make sense to assign that individual to be the liaison with the National Guard. A National Guard member may or may not be available to do communications, depending upon what duty is required of him or her.

"How?" is the toughest one, because it is the link to all the other questions. Unlike the reporter, we are not concerned with what has happened, but are more concerned with what *will* happen. This is the sum and substance of your plan.

Planning is important. In his book *It Doesn't Take A Hero,* General Schwartzkopf pointed out that he fought in three wars, and they were in the last three places he ever would have expected when he graduated from West Point. The lesson here is that we all need to plan as best we can, because what we will face may be totally unexpected.

Get involved, now. Think about going through a damage assessment or shelter management class, and while you're there, learn CPR and first aid. Work with the area's Emergency Coordinator, and get involved with the folks you'd meet during an emergency. It's only a matter of time until you meet them. We should put at least as much time into planning for a disaster as we do planning our vacations!

As the robot said in the movie *Short Circuit,* "Input! I need input!" Let me know your ideas, suggestions, etc. Use E-mail, snail-mail, whatever. Your ideas are very important! Besides, now that I'm settled into my new home, I always love to get good mail besides the usual bills. Happy New Year!

Number 58 on your Feedback card

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Sound!

Although we hams send video, computer data, Morse code and more over the air, more than anything else, we send voice. It makes sense, because voice is the normal human mode of communication, and most people find it easiest and fastest. Besides, we're just plain comfortable with it. What could be more natural?

In order to get your voice across the ether to another ham, you have to have all kinds of things, including a radio, antenna, license, electricity, usable ionospheric propagation, and so on. Between your voice and your radio is the microphone, and its characteristics matter a great deal. This month, let's look at issues regarding audio, because, ultimately, sound is what it's all about!

Not hi-fi

Chances are, you own some kind of audio equipment, be it a portable headphone stereo, a full-blown audiophile monster system or, more likely, something in between. Especially with CDs so popular, everyone is getting accustomed to hearing essentially perfect, noise-free sound all the time. Not that long ago, FM stereo was considered "hi-fi," and a good LP (remember those?) seemed nothing short of amazing. By today's standards, though, FM stereo is good enough only for listening to in the car, and the vinyl record seems so noisy that many people can't stand it at all. As our ears get trained, we are bothered by things we used to ignore. It's much the same with visual stimuli. Take computers: Do you remember when the Apple II's graphics were considered high resolution and looked fabulous? We all loved the games and animation—wow, they were even in color—but we would find them primitive and hard to take in today's world of Super VGA and Macintosh graphics.

Undoubtedly, you've noticed that amateur radio doesn't sound anything like what you're used to hearing, even on the AM broadcast band, let alone FM stereo. The fact is, ham radio just isn't hi-fi. That's not some kind of sloppiness on our parts, though—it's deliberate! As it happens, commercial two-way and public service radios don't sound any better. Why would we want to make our communications systems sound less than great? In one word, economy.

Squeeze 'em in

No, I don't mean that we want to make our radios cheap! In fact, ham radio gear isn't cheap at all. Most of it costs a lot and is made very well. I'm referring to the spectrum cost of sending high-fidelity information. The wider the audio frequency response you send, the more bandwidth you use up. Recognizing this, the FCC has deemed that our voice signals shall have no more than 3 kHz of frequency response. To give you an idea of how little that is, a telephone gives you 5 kHz, FM stereo goes to 15 kHz, and a CD player goes to 20 kHz, which is about the limit of human hearing with a good, young set of ears that hasn't yet been ruined by overexposure to loud rock music. For many middle-aged people, 12-15 kHz is the upper limit, while some elderly folks, and many rock musicians, often can't hear over about 8 kHz on a good day.

Other factors

There's more to audio fidelity than frequency response, though. Two other big factors are noise and distortion. On both of these issues, two-way radio gear falls short of the hi-fi mark, too. On HF, signals usually refract off the ionosphere when long distances are involved. Nature being the imperfect lady she is, the steadiness of that refraction is poor, resulting in fading, blasting and other maladies. So much for hi-fi audio.

On VHF/UHF, things are a little better. Up there, we usually use FM, which is capable of darned good audio. Communication distances tend to stick to line-of-sight range, so ionospheric disturbance is pretty much nonexistent. So, why don't our walkies and mobiles sound like commercial broadcast radio? For one thing, we use very narrowband FM deviation (modulation), which goes farther for a given amount of power and lets more stations share the band. The drawback is that, even with strong signals, it is noisier than wideband deviation, because the tiny wobbles and noises present in the transmitted signal represent a bigger percentage of the total modulation, making the receiver interpret them as louder sounds during demodulation.

Intelligibility

We really don't mean for two-way radio to exhibit hi-fi sound. Rather, we're after another goal: intelligibility. That just means the most understandable reception of speech, even under bad conditions. It would seem intuitive that the most intelligible signal would be the one with the highest fidelity, but it doesn't work out that way. As it happens, you can do things to speech signals that make them sound worse but also make them easier to understand through noise and fading. These processes are a kind of deliberate distortion. Let's look at a few:

Getting flattened

On HF, a very popular form of intelligibility enhancement is called "speech processing." This process takes the voice signal and amplifies it in a circuit until the peaks are clipped off. Then, the signal is filtered to remove most of the harmonics and other wideband noise which results from such clipping. The result is that the softer sounds in speech are brought up to a level almost equal to the louder ones. At the receiving end, it sounds a little peculiar, but it makes it much easier to hear the speaker's softer syllables, which hold many clues to understanding words. A processed signal can often be clearly heard when an unprocessed one would be hard to decipher. By the way, hams tend to fall into one of two categories: They either love speech processors or they hate them! That's a result of many hams' pushing the processing too far by turning up the processor control toward maximum, thinking that more processing means more "talk power," or intelligibility. The resulting sound is grating to the ear. Heck, on some radios you can turn it up so much that the distortion products aren't completely removed, resulting in an RF signal that's way too wide to be legal and annoys hams on adjacent frequencies as far away as 10 or 20 kHz. We call it "splatter."

Getting squashed

Another form of intelligibility enhancement used on HF is compression. This is something like the automatic volume control on a cassette recorder, only faster. This one "rides the volume control" fast enough to keep it fairly constant between spoken syllables. Although it doesn't create the kind of distortion you get with speech processing, it still sounds weird if

pushed too far. Its ultimate effect is similar to the clipping system, in that it equalizes the levels of loud and soft sounds. It's not quite as effective in punching through noise, though, so clipping is still preferred by most hams, despite its often-realized potential for ugliness.

Up yonder

These forms of processing are used on HF, not VHF or UHF. Why don't we use them there? For the most part, they just aren't necessary. Our use of FM for most VHF/UHF work, along with the much lower atmospheric noise in that part of the spectrum, lets us have clean enough sound to begin with that we just don't need to crud it up with deliberate distortions. Besides, with weak signals on FM, adding extra modulation can have the opposite effect it has on AM and SSB; it can make your signal drop into the mud. Most rigs in these frequency ranges do employ a small bit of compression, just to keep the signal within prescribed modulation limits, but that's about it. So why do they often sound so different?

The ear

Your radio's ear is its microphone. Given the essentially low-fidelity nature of the ham radio medium, what possible difference could the mike make? More than you might think! True, the upper frequency response of just about any microphone is greater than our measly 3 kHz, so that doesn't matter. The low frequency response does matter somewhat, but SSB radios cut off below about 200 Hz, so you're still not talking about that much difference. What's left?

Between the lines

Imagine a graph with a line on the left representing 200 Hz, and a line on the right representing 3 kHz. Between those two points, you can draw a heck of a lot of different curves and wiggles. Different microphones have frequency response curves that can vary quite a bit. Let's look at a few:

Condenser mikes, used on all FM walkie-talkies and many HF radios these days, have the flattest curves of all. That means they interpret your voice pretty honestly. Is that good? On VHF/UHF FM, they sound nice. Remember, with this mode we aren't so concerned with punching through noise—we just want clear sound. On HF, though, condenser mikes tend to sound "bassy," which means the lower frequency response is too strong. In fact, it is the correct response, it just isn't the one we find most desirable. Thanks to the structure of the human vocal system and ear, many clues which help intelligibility are located in the 2–3 kHz range. By reducing the lower frequencies, we can make the radio appear to increase the upper ones, much like turning your stereo's bass down makes it seem like there's too much treble. Thus, less-bassy mikes are desirable.

Ceramic mikes are often used to achieve that "peaky," trebly sound DXers love so much. These mikes have a natural response curve that rises with frequency, giving them that punch. To simulate the ceramic-mike sound, some newer radios have a "high boost" switch which increases the treble sounds at about the same rate as a ceramic mike.

Dynamic mikes, which are magnet/coil combinations almost exactly like speakers, also have a rising response curve. Theirs is not so dramatic, though. Older FM rigs used them, but they were replaced by the now-common condenser mikes, which are smaller and cheaper. Also, dynamic mikes sometimes have very poor low-frequency response, so much so that some have a "yelling down a hollow tube" quality many people find annoying. I've heard some on HF that were pretty hard to take.

Well, I hope you've enjoyed this little sojourn down the audio path. Until next time, 73 de KB1UM.

Number 60 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Frequency counters and accuracy

There are so many different types of frequency counters out there in the marketplace, it can be a very confusing venture trying to pick out one for personal use. Helping to make the shopping trip a hassle are the various types for portable, stationary, general, workbench, and laboratory use. All of these categories provide industrial types as well as consumer types, with the differences being price and features.

It's like going to Baskin Robbins™, as there are at least as many varieties in frequency counters available for the amateur radio operator to choose from. In spite of all this possible selection the choices are not all that difficult. I thought I would devote this month's column to covering some frequency counter attributes, giving you a measurement device to grade the unit you might be thinking of purchasing. Don't think that these are absolute, as there will usually be some personal criteria you'll want to address.

When we go shopping for a piece of frequency measurement test equipment, we have most likely defined what we are willing to spend. Cost seems to be the most important feature in any consideration.

Well, then, there are several frequency counters, available new from a multitude of suppliers, aimed at the amateur and commercial markets.

What these small portable hand-held frequency counters all have in common is battery operation and frequency measurements capability to about 2000 MHz (2 GHz). Displays vary; plasma, LED and LCD are most common. Maximum frequency of operation varies from unit to unit, with most working to 500 MHz and some of the higher-end units functioning to over 2 GHz.

Most units have optional higher stability clock crystal oscillators available at an additional cost. What these higher-accuracy oscillators do is to improve accuracy performance in measurements. What do we mean by "improve" frequency measurements? Well, before we select a unit off our local dealer's shelves, let's see what it will provide for us in terms of operation.

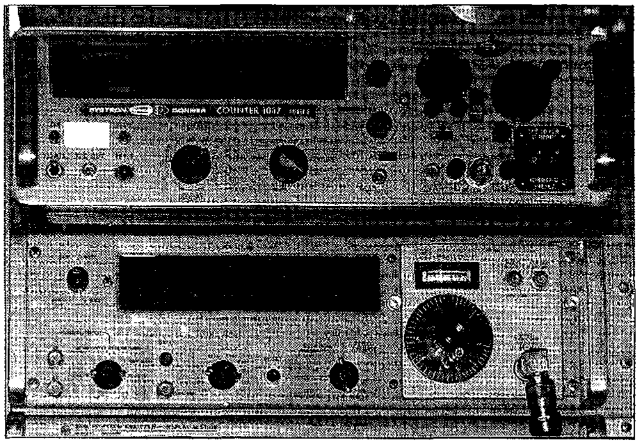


Photo A. The old reliable HP-5245 base counter on bottom, shown with the Systron Downer 1037 on top. Not a match but quite similar in operation for main units and plug-in units. (Note: Plug-ins not interchangeable between units.)

Let's start by establishing a few objectives. Factors we will examine will be frequency error on measurements, and sensitivity. Sensitivity is the easiest to define. Most of us want something that we can fit with an antenna or rubber ducky type of antenna; key our HT on low power nearby (or separated by some five to 10 feet); and get a suitable reading on the frequency counter. For others of us sensitivity means minimum signal sensitivity, in dB.

Minimum signal in dB can be something in the -10 dB range for most inexpensive counters in the $200 or so range. In this application you would be testing frequency with an oscilloscope *times 10* or *times 1* probe, and making direct connection to low-power oscillators to determine their frequency output.

Most all small-frequency counters can be used in either of these two methods, and work well as far as sensitivity goes. If you need more sensitivity to work with very low-level signals, an external MMIC RF preamplifier could be easily constructed, just like using the preamp on a receiver.

In my shack I have collected several amplifiers that cover a multitude of frequency ranges. Some are only good to the low frequency of 60 MHz and below. These have proven quite valuable in looking at very low-level circuits, on not only the frequency counters, but a low-sensitivity spectrum analyzer. Units that are wide-bandwidth to a GHz or so can be very helpful to improve performance at these higher microwave frequencies, where counter sensitivity is decreased, as compared to its lower-frequency operation.

The next point to consider is frequency accuracy. This can be a touchy subject, as there are so many different answers in how manufacturers post this information, making it somewhat hard to compare different units. Let's discuss what's going on before we continue on accuracy.

Any frequency counter depends on a clock or internal local oscillator that is used as a standard. The accuracy of this standard, internal to the counter, determines how accurately the counter can read frequency. This one point, frequency meter accuracy, has led to many arguments and conjectures. The problem is that the frequency counter readout reads a frequency no matter how accurate a time base standard you have. The problem lies in knowing whose frequency meter is correct, or what the margin of error is, on each counter used in these tests.

Let's look at a few scenarios using different-type stability local oscillators and see just what happens. It doesn't matter whose frequency counter you apply this test to, as it's the same for all of them, be it commercial (Hewlett Packard, Systron Downer), or inexpensive battery-operated amateur-type counters.

There are many different methods used to state frequency meter accuracy. Some state accuracy expressed as 1 ppm, or high-accuracy units rated at .1 ppm. Other specifications state ± 2 hertz at 1 MHz. Another might state the accuracy to be one part in 10 to the ninth power (1 part in 10^9). How then do you make comparisons when you are faced with apples, oranges, and *pears?* What do these numbers mean? How do you compare them on an equal footing?

The equal footing is in the standard crystal oscillator, as I said before. Let's assume, for example, that we are capable of measuring this oscillator with a perfect frequency counter—no error at all. If we measure a 10 MHz oscillator and find its frequency to be 9.999980 MHz,

this would be indicative of the oscillator spec that states its stability to be ± 2 Hz per MHz. We read the frequency to be 20 Hz, low in frequency, with a spec of 2 Hz per MHz. Translating that to 10 MHz would be 2 Hz times 10 MHz or 20 Hz—and that could be either high or low. Quite an error.

If you were to read a frequency of 145 MHz with such a counter, whose time base had a 2 Hz per MHz error, the final error translated to 145 MHz would be almost 300 Hz off frequency. Evaluating the frequency counter whose time base oscillator was 1 ppm yields errors at 145 MHz to be a 145 Hz error. That is one part per million, or 1 Hz error in 1 MHz—so for 145 MHz the error could be 145 Hz.

Some new frequency counter manufacturers provide (for an extra sum) a "high-accuracy time base crystal oscillator" with stability in the .1 ppm range. Measuring the same 145 MHz frequency with a .1 ppm time base results in errors of 14.5 Hz. It's getting closer to being ideal. The more tightly the time base is controlled to an exact frequency, the better—or the less error the frequency counter will read.

Now let's cover some premium frequency counters. As you can imagine, commercial operators cannot tolerate these kinds of errors. It just won't do to set high-frequency equipment and have an offset in frequency due to the accuracy of the frequency counter. Commercial time base oscillators are quite accurate. By accurate I mean more like the one part in 10 to the ninth or so. What does that mean in ppm (parts per megahertz)? Well, that's .001 ppm basic time base accuracy; or, stated another way, that's 1/1000 of a Hz at 1 MHz.

If the accuracy was .1 Hz per MHz that's the same as 1/10th Hz per MHz, or .01 Hz per MHz is the same as 1/100 Hz per MHz. That is getting very accurate for the workbench or ham shack. Transferring this into atomic frequency standards, this is a drop in the bucket; they are capable of one part in 10 to the 12th—that's .000001 Hz per MHz. This is getting serious here in terms of accuracy.

How much accuracy do we need to have a good frequency counter? Well, the question can be best answered by cash cost basis. The more accurate units tend to be more expensive. There are exceptions to this rule, in that surplus military and swap meets might yield a suitable surplus/used frequency counter of high accuracy.

Accuracy for most any amateur project up to 500 MHz is easily satisfied with a .1 ppm frequency accuracy. I have several 1 ppm units in my shack, and, knowing that they give readings with errors of 1 Hz per megahertz, I adjust to them and don't rely on them for exact readings, but close indications or checks are suitable.

It's more important that you know what is going on and what your possible errors may be—then they become manageable.

On the other hand, it's not all rosy with a very high-accuracy frequency counter, as to keep things in tow you must have a calibration source, to verify how accurate your counter time base is, and adjust it accordingly. They all drift at different rates and must be monitored and adjusted to keep them accurate. A very expensive counter with an excellent time base that hasn't been calibrated in several years or months will be off frequency an amount that is somewhat predictable as time progresses.

The crystal time base oscillator ages and in this process changes its frequency with time. A small tweak on a variable capacitor in the circuit is needed to bring the unit back in calibration. I have watched my units drift over several months' time. I first set the unit to within 5 millihertz by making a phase tracking run for 10 hours with WWVB on 60 kHz for exact calibration. In the months that followed I observed a slow low-frequency drift in frequency that after one year totaled 25 to 35 millihertz lower in frequency than when I started.

Photo B. *DigiMax 500 MHz frequency counter with older DSI (Digital Signal Instruments Co.) which became DigiMax. Quite good battery-operation portable counters good to 1 ppm.*

This kind of error is not bad at all, but points out the needed calibration on any frequency counter, be it a high-accuracy unit or a lower-accuracy one. The lower-accuracy units tend to drift about and will make large changes in frequency due to varying temperature and voltage

variations. Higher-accuracy units can take advantage of TCXOs (temperature-compensated crystal oscillators) and greater stability. Oven-type crystal oscillators are even better once they reach temperature stability, as they hold the crystal in a fixed temperature.

There is still room to gain on stability here. Some of the very high-quality crystal standards (time base oscillators) are of the oven heater type but take a different turn. They are constructed with a very slow-acting time constant oven circuit. This oven circuit is usually covered by insulation and has a second temperature-controlled double-insulated oven over the first unit. The purpose of the two ovens is to provide increased temperature stability to the crystal, protecting it from very small temperature changes.

This entire two-oven heater system is then inserted into a high stability temperature compartment, which is very much like a wide-mouth small thermos bottle. The open end of the bottle is sealed, making the temperature controls an internal function within the confines of the thermos bottle for increased temperature stability. The outer oven heats to a fixed temperature with a much faster time constant.

After 24 to 48 hours both ovens reach temperature stability inside the vacuum bottle and hold the crystal to a precise temperature that changes very little with external effects impressed on the unit. Of course, we are talking about a high quality frequency standard of secondary accuracy to the primary located at WWV and WWVB and the NIST department of standards.

What type of counter do you purchase?

The bottom line for frequency counters, now that you are prepped on the accuracy of them, is to go shopping and see what you can find that will fill your requirements. Determine how high in frequency you need to measure, and to what accuracy—then you are going to have to decide on either commercial surplus (or military surplus) vs. new counters offered for sale.

There is much to say for older counters that were made by Hewlett Packard and Systron Downer (and quite a few others). The HP-5245 is quite good to 50 MHz by itself, and with a range of plug-ins, will extend frequency capability to 18 GHz. The same is true for the Systron Downer 1037 series which is similar to the HP 5245. A new arrival on the surplus market is the HP-5328a which is nice but only goes to 500 MHz. I have observed several of these counters being offered for $100 at swap meets in (alleged) working condition. Try them out before purchasing, using your HT and a paper clip, if needed, to check them out. If they pass this test you can't go too far wrong.

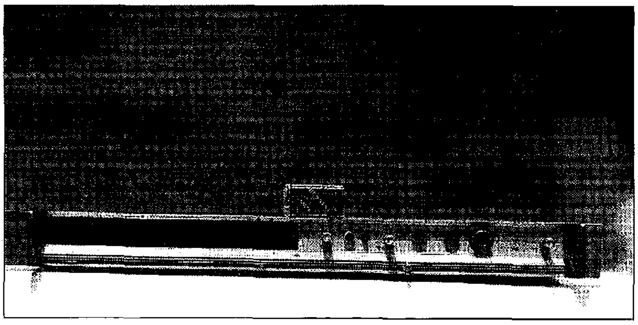


Photo C. Surplus Systron Downer 6036 counter good to 12.4 GHz. Note size of unit compared to 9-volt transistor battery on top of counter. Time base accurate to slightly better than .1 ppm.

A very nice Systron Downer counter is the 6036 which is a low-profile (one inch high) counter sporting direct readout to 12 GHz. Saw a few of these being offered for $150 each, in as-is condition, at our local surplus dealer. Picked up one for experimentation and with a little work got it going. It's a little temperamental but works most of the time. The problem is some tired magnetic slide switches and some old TTL/RTL logic chips that were hard to find to put all the switch ranges in service.

On the new side, there are many counters being offered by several companies. Startek, Optoelectronics, and DigiMax are a few. I have several different units made by DSI—the old name that became DigiMax. As this is a San Diego-based company, it was easy for me to pick up their units locally. Which units do I recommend? Well, I have several, but I like the new units for portability, and the military commercial units for their accuracy on the bench. All units pictured are from my workbench.

Next month I will go into some features each have. There are some very unusual ones that are unique to each frequency counter. Please don't hesitate to drop me an E-mail note. It is so much easier to answer questions or just chat about something and it's very inexpensive. 73 and Happy New Year. Chuck WB6IGP.

Number 62 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

FARS, friendship, and foxhunting

There's lots more to amateur radio than QSOing, keyboarding, and building. To many hams, it is a fine way to make lasting friends and promote world harmony. None do it better than members of the Friendship Amateur Radio Society (FARS).

FARS was founded as a Sister Cities project between Portland, Oregon, and Khabarovsk, Russia. Not content just to talk on ham radio, exchange E-mail and make occasional personal visits, these hospitable hams started a biennial tradition—the Friendship Radiosport Games. For a week-long period, FARS members come together in a host country for sightseeing, camaraderie, and friendly competition in traditional amateur radio skills. There are QSO contests, CW sprints, and a trip to a big woodsy park for radio direction finding (also called radio-orienteering, fox-teering, foxhunting and ARDF).

Since the first FRG in 1989, held in Khabarovsk, FARS has grown to include chapters in two more Sister Cities: Niigata, Japan, and Victoria, Canada. Other competitors, including transmitter hunters from California and Washington state, have joined the fun. Rivalry for the coveted FARS Traveling Trophy remains fierce, yet friendly.

"Homing In" has chronicled the growth of the Friendship Games. See the September 1991, November 1991, October 1993 and December 1996 issues of *73 Amateur Radio Today* for photos and stories of previous competitions.

Japanese red-carpet welcome

FRG-97 was in mid-August at Kanagawa Prefecture, near Tokyo, hosted by the Kamifusen Ham Radio Club. ARDF is this club's primary activity, so the two-meter foxhunt on Sunday was both the climax and the highlight of the Games.

Japanese radio-orienteers are outstanding; they compete regularly in IARU international championships. Members of the host club include some of the top Japanese ARDF stars, including OMs Noriyuki Ariyoshi JM1CVC, Nobuyishi Akutsu JM1VUH, and Koichi Andow JA1SBH. There are outstanding YLs, too, such as Jyunko Ariyoshi JM1JKR and Yoshiko Yamagami JQ1LCW. Yoshiko, a participant in all five FRGs to date, shared hosting responsibilities with Osamu Toyofuku JA5RMR.

The Russians have been proficient foxhunters for many years. The relatively new Canadian team had been practicing hard for the two years since their first trials at FRG-95 (**Photo A**). Into this fray came a much less experienced USA team. Two of its most promising members were first-timers at the Games. One was Dale Hunt WB6BYU of Yamhill, Oregon, a town of 700 souls about 28 miles southwest of Portland (**Photo B**).

"I started transmitter hunting in Sacramento around 1970," says Dale. "It was on 75 meters with the Radio Amateur Mobile Society on their periodic 'rabbit hunts.' I built a loop antenna and used a Heathkit HW-12 in the car. You didn't have to get out on foot. I always managed to ding up the car, including the time I came back home with the fender and bumper in the rear seat on the laps of the passengers because we had an altercation with a passing pickup.

"When I moved to the Portland area in 1992, there was some interest in transmitter hunting," WB6BYU continues. "Over the next year we got mobile hunts going. In 1993, I got an invitation to the Friendship Games in Victoria, but I had a conflict. I kept in touch with the Victoria hams on packet and a year ago on Labor Day, two of us went up there to try it out. There were two hunts that day in two parks and we fared a lot better than we thought we would. After that, I scrounged some 'bunny boxes' for practice. They weren't synchronized, but they did the job.

"My wife talked me into going to the 1997 Games in Russia. Unfortunately, on the weekend before Field Day my car got smacked by a fellow running a red light. I got four broken ribs and a broken sternum and was in the hospital for a few days. I had mowed the perimeter of our property for a practice running track, and when I was able to get up, I walked it. I knew I wasn't going to be able to run, but I figured if I could walk the course and find just two foxes and get back in time, that would be a victory for me. It was probably just two weeks before the contest that the pain finally went away."

Also new to the 1997 Games was 16-year-old Jack Loflin KC7CGK of McMinnville, Oregon (**Photo C**). Jack was a novice at foxhunting, but not at ham radio. "He showed up at our Field Day one year and worked the HF bands third party," says WB6BYU. "I told him that next year I wanted him to have his Extra because I needed some help on CW. He did it! He said the hardest test questions were the rectangular-to-polar coordinate conversions, because he hadn't had geometry yet. But he got his Extra while in the 8th grade. Now he's working five days a week repairing computers for the school district and doing marine patrols on the river for the Sheriff on weekends."

"I got started hunting in cars," Jack told me. "Our club did monthly hunts. We had a blast going out on those. I wasn't driving at the time, so I conned my Mom into taking me. I heard stories about the 1995 trip to Russia and then had the chance to go to Victoria with Dale. I decided I wanted to go to Japan, so I scraped up enough bucks to go. I ended up working two summer jobs and got my parents to foot half the bill."

Rounding out the US foxhunting team were Greg Hodsdon K7KJ and Kevin Hunt WA7VTD. Greg is a veteran of previous Friendship Games and Kevin is one of the FARS founders. He presently serves as general counsel of FARS-USA.

Camaraderie and competition

"The actual FRG-97 contests took place over two days," Kevin says. "The remainder of the week was devoted to companionship, climbing an active volcano, sightseeing on boats and cable cars, attending the JARL National Convention, playing at Tokyo Disneyland™, shopping, and planning future events."

"I had a great time," says Jack. "The friendship part of it really comes out. People were always exchanging gifts and having great conversations."

On the morning of the last full day of the Games, everyone headed for Fujinoengei Land, a rugged, mountainous, thickly-forested primitive area near Lake Sagami, in Kanagawa Prefecture, about two hours from the hotel. The park is next to the lake where Olympic rowing competitions have been held.

Official foxhunting rules of the International Amateur Radio Union (IARU) were closely followed. The five hidden fox transmitters, all on the same two-meter frequency, beaconed for 60 seconds each in numbered sequence. Competitors had to find as many as possible in two hours; exceeding this time limit meant disqualification. Identification was an easy-to-copy CW pattern. Foxes were concealed, but a nearby flag was visible from at least five meters away. A distinctive punch was attached to each fox for the competitors to mark the cards they carried.

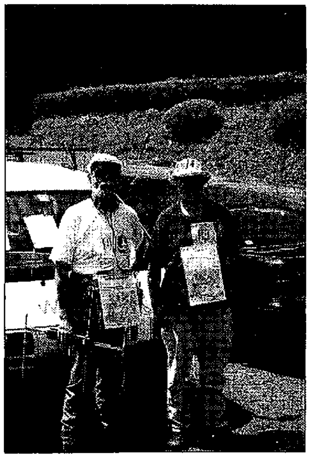


Photo A. John MacConnachie VE7GED (left) and Joe Young VE7FBK/7J1AZO represented Victoria, Canada, at the FRG-93 foxhunt. (Photo by WB6BYU.)

Contestants were divided into four categories: seniors (males 18 to 40 years), juniors (boys under 18), women (any age—nobody asks!) and old-timers (males 41 and up). Seniors (also called OMs) were required to find five foxes, other categories only four. "Unlike IARU competitions, they did not specify which fox didn't need to be tracked," says Dale. Foxes could be found in any order.

"It was a good three kilometers around the course, depending on the way you decided to go," Jack

Continued on page 74

Photo B. Dale Hunt WB6BYU cools off and celebrates just after completing the 1997 Friendship Games foxhunt in Japan. (Photo by KC7CGK.)

Ham Radio Fun

Marsha and Me

Making friends via hamming.

Arthur R. Lee WF6P
106 Western Court
Santa Cruz CA 95060

It is amazing to consider that any time you answer or send out a "CQ" you stand an excellent chance of meeting a lifetime friend. Of course, we have already self-selected those who are going to answer us. They will be fellow hams, worldwide, who have an understanding of the hobby. This includes radio theory, operating procedures, and the licensing procedure and structure. In other words, we are all thinking the same thing—the fun of communications.

Our hobby is not the same as owning and operating a cellular phone—or even a telephone for that matter. With that method of communications, there has to be someone at the other end whom you intend to contact. You would not normally drop a quarter in the slot of a pay telephone and dial a number at random. If the person answering should ask, "With whom do you wish to speak?", you would be hard pressed to keep him on the line if you replied, "Oh, just anyone!"

It's a different story with radio amateurs answering your call. Who is receiving your request to talk to someone? It could be an eight-year-old child coming on the air for the first time, or an astrophysicist with postdoctoral credentials. Medical doctors, lawyers, sailors and soldiers, bankers, farmers, housewives, and others from all walks of life belong to our hobby. A king? It could happen. A group of middle school students talked to King Hussein JY1 once from their club station in Santa Cruz (California). My brother-in-law KB6TZA would like very much to talk to his guitar-playing idol, Chet Atkins—also a ham.

In all my nearly two decades of hamming, I have met hundreds of interesting people, many of whom have become lifetime friends. I know of hams who have been in contact with DX stations around the world and, when in those countries, visited these operators for days or weeks at a time.

Photo A. *The family that hams together has fun together! Shown in their ham shack, the Messers: Brad KC7KTL, Marsha AB7RJ, and Jim KK7AL.*

One long-time ham visited Europe a few years back and was invited to the homes of his friends in over a dozen different countries. They, in turn, have been invited to his home on a reciprocal basis. I once made contact with a ham on Macquarie Island, in the Pacific Ocean. He paid me a visit when he came through California.

We hams are friendly people. If we weren't, why would we want to talk to strangers and they to us? The amateur radio hobby is one where unfriendly people tend not to congregate. The very essence of the CQ we send out is, "Is there anyone out there who wants to talk (to me)?" Yes, we are here, there, and everywhere.

I have been in contact with hams in Africa, Russia, Romania, England, Antarctica, New Zealand, Australia, and on the high seas. All have one thing in common—the need and desire to talk to others. We love to share ideas or experiences with each other. Over the years, many lives have been saved by helpful hams in emergencies. I would liken our hobby to a fraternal organization which all are free to join. When I teach ham radio classes, I tell all my students that if they are out on the road and in need, if they see a ham antenna, go there for help.

Recently, after being off the air for a few months, I decided it was time to get in some long overdue CW practice. I listened around the 40-meter band awhile, heard nothing, and so started pounding a little brass. "CQ, CQ, CQ," I sent. "This is WF6P." After a few tries I was just about to change frequencies when an answer came back, loud and crystal clear, answering my call.

I sent out the customary information of signal strength, home town, and name. It turned out that it was a young lady (YL) in the state of Washington. Her name was Marsha. We carried on our chat at about 10 words per minute and I was struck by her CW accuracy. She must have had a good teacher, because her error rate was practically zero. Her code was not only easy to copy, but she answered all my questions with a fine touch of humor. Did I hear right? Some of the expressions she used seemed vaguely familiar. Was she married to a serviceman? I had served in the Navy many years ago and recognized the nearly forgotten terms she used. We talked for an hour, at the end of which I asked if she would be on the air again tomorrow. After some hesitation, she said, yes, she would.

The following day I gave her a call. Many times, schedules are made but not kept for one reason or another. When I sent a "K", I was ready to move on if she wasn't there. "WF6P, WF6P, de AB7RJ" came back, crystal clear! OK, I thought, let me now get some more information from this interesting person.

No, her husband, also a ham, was not in the Armed Forces, but she was. She had served as a Navy WAVE. She wanted to become a radioman back then but was put into another rating. We talked about the Navy of the '50s (mine) and '60s (hers). She had served as an Admiral's yeoman at the Pentagon. I had been an aviation mechanic serving with the Pacific Fleet. She was not short on conversation so we continued on, firing questions and answers back and forth.

Her husband, their son, and her husband's father were all hams. They were studying together to increase their proficiencies in ham radio. All were working hard to improve their code speeds to attain higher license classes. Another hour of CW passed. Would she like to meet again the next day to continue our CW practice? Yes, that would be fine. Our chats took place at 0830, just right to enjoy those morning cups of coffee.

What did we talk about? Nothing much. How's your weather? What are you going to do today? This weekend? River rafting? Wow! Tell me about that, what's it like? Isn't it dangerous?

We met daily, at the same time and frequency. Our conversations expanded into details of family life—who, what, why, and where. Sisters and brothers, schooling, hobbies, and goals. All were grist for our CW mill. Occupation? Marsha, besides being a wife and mother, worked four different part-time jobs. She served in a restaurant, ran a machine that packaged Christmas trees, baked and sold baked goods, and made and sold decorative sports shirts. Now there was an energetic person!

It has been over a year and a half since we began our daily CW practice. We skip weekends. Our agreement is that if either operator is unable to make the schedule, that is all right. We have rarely not made contact and usually let the other know, beforehand, of planned absences. All in her family have advanced their license grades. She and her father-in-law hold Extra class licenses.

Last August, with airline fares being low, Marsha and her sister came to visit me and my family—also all hams. En route to visit hams in Reno, the two women met us at the airport in San Jose. We spent three days and three nights together at my home. They were able to meet my family and other hams in our area. It was fun to entertain our out-of-town, newly met, but old, friends. We shared stories of ham radio adventures. We went to the beach and toured our town. Marsha brought along her Navy and family photo album. My son and his wife brought his accordion down from Sacramento for Marsha to play. Gathering around the piano and singing popular songs was enjoyable. Marsha met my unforgettable piano teacher and we entertained in her studio.

Marsha and her sister have returned to their families and my visiting children to theirs. We miss them all, but are no further apart than our rigs. 73

Publish or Perish

There's something in this reprinted article for every *club.*

Marc Stern N1BLH
c/o *73 Magazine*

One of the most important offices in any club is that of newsletter or bulletin editor. That task provides the glue that binds a club together during the month. Like completing a circuit, a club's monthly newsletter provides a path through which the news and notices flow.

Newsletters typically range from professionally typeset, printed, and bound publications [or the now more familiar desktop-published efforts—ed.] to one-page sheets that are hastily run off at the corner copy shop. Unfortunately, there are far too many of the latter across the spectrum of radio clubs and far too few of the former.

Usually, the more professionally done newsletters are found in clubs that not only have an active membership, but are also exciting. These clubs have a dynamism and energy that spreads from the youngest member to the oldest operator. Quite likely, they also have active class programs that encourage new operators to enter the hobby, as well as active social, educational, and operating calendars to keep everyone interested.

This isn't to say those clubs with one- or two-page newsletters may not be equally active and exciting. What they probably lack is the funding to handle the printing, which can easily run over $1,000 per year for a 100-member club with 11 or 12 newsletters.

Still, it's unlikely that clubs that hastily print one-page, poorly-typeset and -reproduced newsletters are very active. Quite likely, the president not only heads the club but also writes the newsletter; takes the minutes; handles correspondence; finds speakers, films, or activities—as well as typing up the mailing labels and licking the stamps. It's a one-man show that has fallen on his shoulders by default. All it takes is one volunteer, the editor, to begin changing this picture, and the newsletter is off the ground.

However, while volunteers can make a great deal of difference, another key ingredient to a successful newsletter is the willingness to fund the cost of production. Unless someone in your club owns a print shop or knows someone who does—an ideal situation—the chances are good that you'll find you have a monthly cash outlay, which a club can't be afraid to make. Since the newsletter is the most visible part of the club to many hams and community leaders—if they are included on the mailing list, which they should be because it's just good public relations—and since it is also the primary news medium for members and potential members of the club, it pays to do the best job your club can afford.

If, for example, you can afford professional printing but not photo work, then don't use photos. Retain the professional printing, however; it lends a finished look to the publication.

The most important ingredient after the editor and funding is support. Since the newsletter is the club's mouthpiece—not the editor's private soapbox or the executive board's private opinion sheet—the editor must encourage club input. In many cases this is like pulling teeth from the proverbial chicken, but it still has to be done.

For example, in the club where I am newsletter editor—the Framingham (Massachusetts) Amateur Radio Association—I have encouraged members to submit whatever they want to submit, and I've had a fair degree of success. Recently, a couple of our women members asked if they could have some recipes published and I said, "Why not?" Yes, it did raise hackles, but it shows the type of latitude we try to allow in the newsletter.

And other times, I've had people come forward with long lists of DX operations and beacons and we've published those, too. In fact, there have been some months when I've had so much material, I've had to hold some until the next month.

I just wish that were the case all the time, but like most editors I've found that it isn't. Much of the time, I'll write just about everything in the newsletter except the minutes of last month's meeting, repeater notes, and a listing of local flea markets, exams, and special events. These are provided for me.

And this brings us to another consideration: format. Before the final printing, it's a good idea to experiment with format on a dummy issue. If many of your club members are older operators, then it makes sense to use larger type so that it's easier for them to read. Likewise, it also makes sense to print text in full-page format rather than in columns, which can be somewhat harder for older operators to read.

On the other hand, if most of your members are on the younger side, then experiment. Try various type sizes and styles to give your newsletter a unique flavor.

For example, the newsletter of the Nashua (New Hampshire) Area Radio Club, which I see as part of our newsletter exchange, has a professional appearance. Not only is it printed in two-column format, but the type style is clean and readable. Also, the club includes photos, which give its newsletter a professional feel. Besides, it's apparent from the photos that the membership is active and supports not only its club, but also its newsletter.

Another unique newsletter I have seen is that of the Wellesley (Massachusetts) Amateur Radio Society. WARS makes effective use of two-column format and graphic and shaded headlines to create a very pleasant newsletter. The writing is light and the typesetting good, setting this newsletter apart.

Looking at the other side of the coin, I have seen newsletters that are basically mimeographed or photocopied one-page throwaways that do little more than announce the meeting and the meeting site. They aren't too informative and look so amateurish that you have to wonder about the quality of the club. The print quality is also usually poor because a wide-matrix dot-matrix computer printer has been used, making everything look shoddily prepared.

With the editor found, funding and support ensured, and format determined, there's little more for the editor to do except put the newsletter together, right? The answer to that, unfortunately, is, "Wrong!" Wrong because there's still more to do, as WA1UEH, our newsletter's former editor for seven years, can attest.

Even though we have seen it is possible to establish a moderately continuous flow of material, it requires an editor's vigilance to ensure that this material will keep on flowing. For the most part, a simple phone call gets it in on time.

"The bottom line is knowing a job is done correctly and to the best of your ability."

This information-gathering process has been greatly enhanced by the arrival of the personal computer in the ham shack. Although I use mine for business purposes, I also use it in the hobby, as well as for correspondence. The same is true of other club members, several of whom also contribute material to the newsletter. We can do this because our machines are equipped with modems, which makes it easy for them to zip information to me. All they have to do is dial my home phone; the computer answers, and the information is transferred.

In this manner, we can update the newsletter until the last minute before it is transferred to the club president's machine. He prints it out and has it printed for us. As you can see, there's very little paper that changes hands today, other than in the initial information-input process.

Even with this automation, there are months in which all the persuasion and reminding in the world doesn't produce much copy. In those months you must turn to your alternate sources of

information—other club bulletins, ham radio newsletters, and organizations such as the Amateur Radio News Service.

From other club bulletins, you can usually extract local information about which club is doing what and where local classes and flea markets are being planned or held. Generally, you'll find that between your own input and local bulletins, you may be able to fill half the newsletter.

Your next source of information, then, comes from newsletters such as the *W5YI Report* and *ARRL Letter*. They provide up-to-date information on matters of crucial interest. In fact, many of the newsletters I see make liberal use of the information contained in these and other professionally produced newsletters. The only proviso in using this information is that you must credit the newsletter that originally contained it.

Likewise, the Amateur Radio News Service is an important source of input from across the country. Made up by several hundred bulletin editors, the *ARNS Bulletin* provides you with lighthearted material and cartoon fillers, as well as some serious editorials. You can use this information, provided you credit ARNS. ARNS is a separate group whose dues are $15 a year [in 1997—ed.], but it's money well spent, I have found.

Finally, if you can do it—and if your budget allows it—try to use as many photos as you can. Not only does this create interest in the newsletter, but it also creates excitement in the club, which, after all, is the bottom line of any newsletter effort.

With all of this done, the mundane work is next: folding, labeling, and stamping. If you have several people on your committee, this can go quite quickly. However, most of the time you'll find that you're doing this yourself. Relax, though; it doesn't take too much time and if the labels are computer-generated, it will be little effort to label, stamp, and mail them. In fact, if no one in your club can generate computerized mailing labels, it might be a good idea for your club to invest in having several sets of labels printed. In the long run, it will save time and effort.

When all is said and done, though, the bottom line in the newsletter is satisfaction—the satisfaction that comes with knowing a job is done correctly and to the best of your ability. Don't think that as editor you'll find people rushing up to you month after month to pat you on the back for the fine job you're doing—because they won't. To the long-suffering editor, those comments seem few and far between. But don't think the club doesn't appreciate the job you are doing, either—because it does. It's just that when a newsletter is running well and arrives on time every month, people take it for granted.

In a way, though, having people take the newsletter and its quality for granted is the ultimate compliment. It means they're satisfied with the work you are doing and with the newsletter as a whole. In fact, this type of quiet is reassuring because, as editor, you soon realize that if you blow something, you'll hear about it loud and long. Now, isn't the quiet better? You bet it is, and it means your newsletter's a hit.

So, if you have the right formula, you've got it made. Your newsletter may never win national awards, but it serves its purpose and informs. What more can you ask?

Adapted from an article in 73 Amateur Radio, *July 1986*.

MORE NEWSLETTER TIPS

Fill 'er up

OK, so you've decided to really improve the old newsletter, and now comes the question of exactly what it is you're going to fill those brilliantly designed, professionally produced pages *with*. Somewhere in this world, there must be someone who enjoys reading the minutes of last month's meeting. We at *73* have never met that person.

People

As much as we like to talk about rigs, antennas, and the weather, the most interesting subject in ham radio is *people*. "Fred made a new antenna out of his old Nash Rambler. Bob tried to put up a dipole with a bow and arrow, hit a sea gull, and hasn't seen the antenna since. Crazy Larry fell off his tower again—he's got an HT in the hospital with him and he'd love to hear from you." The one thing people never get tired of reading about is themselves.

Activities

Your newsletter is your chance to light a fire under your club. An "active" club isn't one that just has regular meetings. Activate your club by selling the members on a pilgrimage to Dayton, or a barbecue in your backyard, or something. A newsletter that deals strictly in reporting what has happened in the past will be *boring*. Inject the future into your publication. "Field Day is going to be bigger than ever this year—that is, if you folks will just get going. We've had 27 people volunteer to help dispense the beer, but we could really use some help getting a Novice station set up." Production schedules and delays do have a way of turning your "future" writings into history by the time the newsletter comes out, but at least you'll be closer than you were before.

Plagiarism

We at *73* do not care which of the other ham magazines you plagiarize. But seriously, folks, if you see something in *73* that would be of use in your newsletter, write us a letter and tell us what you want to do. Chances are, unless you're trying to make a buck off the deal, we'll give you the OK.

Art

Someone in your club has enough artistic skill to draw up a clever logo. Find him or her. It's true that you can't tell a book by its cover, but it's also true that your great information will be ignored if it looks ugly. Illustrations and cartoons break up the text and make for easier reading. Somebody in your club must think that he's funny enough to do a monthly cartoon. Give him a chance.

First class

It takes only slightly more effort to put out a first-class publication than it does to put out a boring rag. The editor who has had the job dumped on him and who is given no help in the endeavor is unlikely to make the extra effort—he's also unlikely to be editor for very long. With a little help from *you*, your club's newsletter will be something people look forward to receiving each month. Without your help: "The June meeting was opened and the minutes of the May meeting were approved. Don Dirge brought up the subject of whether or not to move the club repeater, which is currently not working anyway because Bill Bore forgot to ..."

No—Honestly! I'm Not a Pirate!

A tale of travail from a British Novice.

Doreen Stone 2E1DPG
12 Robertson Avenue
Leasingham, Sleaford
Lincolnshire, England NG34 8NJ

It has taken 34 years of marriage for me to become interested in ham radio. My husband and I retired several years ago, and my involvement in amateur radio began in 1995. When I got my license in January 1995, I said to my husband, "I have no rig!"

While he was arranging to set me up with my own equipment, he told me that, according to the licensing regulations, I could use *his* callsign and equipment (under supervision) as a second operator; so he set me up on 20 meters SSB with his callsign. It took him a while to find the microphone that came with the rig (several years ago), as he'd never had a use for it—but it turned up, he blew the dust off it, plugged it in, and I was in business. I worked DX over the next few days and became a confirmed DXer, but I still yearned for my own callsign.

Our national radio society usually suggests that novice operators go on 70 cm and "start talking!" My husband set me up with an FT-790 and a collinear antenna; I duly worked all the locals in my first month of operating. One day, my husband checked my log and discovered that I hadn't been on the air for some two months. Puzzled, he asked what the problem was. I told him that I had been working the same stations all the time—no variety! He offered to set me up on 50 MHz, with the warning: "Be prepared for seasonal activity—but DX can be worked."

I helped my husband put the 50 MHz station together, an FT-690R2 with 2.5 W output. To minimize losses with QRPp, we used a spare piece of Andrews-Heliax, and a relay-controlled switchbox on the mast to switch to either the three-element "Plumber's Delight" beam with its gamma match, or to the end-fed half-wave with its omnidirectional gain. My OM chose the FT-690R2 as, under no conditions, could it exceed the power limitations of three watts output. The switchbox was rated to 1.5 GHz, also to make sure no power was wasted. Minimum VSWR was pruned for each of the two antennas, looking for minimum losses. The station was as I wanted it—I was in business—but then my troubles *really* started.

A word about prefixes

2E1 is the Novice VHF/UHF prefix. Stations operate on 50 MHz and above (less 2 m), with a maximum of five watts input and no more than three watts output allowed, by license conditions. This is QRPp indeed! It's a real challenge—and as the prefix starts with a "2," followed by a letter (indicating the country), and followed by *another* number, it seems to create a mental block in some receiving stations, as the operator's mind tries to make it something more acceptable. I have been called PE1, TE1, GE1 ... anything except 2E1. I have also been ignored, something difficult for an XYL to accept—my husband proved that I was being ignored by calling the station with his Class "A" callsign and getting an immediate response of 5/9—5/9! I'm lucky that I have a husband who can pick up the microphone and explain about the Novice prefix over here—and inform other stations that I'm *not* a pirate (I've been called that by stations in three countries). I usually refer questioners to the *Radio Amateur International Callbook*. There are enough 2E1 and 2EØ stations listed there to make it obvious that my callsign is legal, but I still run into stations who don't recognize the prefix. I have even had some stations say, "2E1, you are a new country for me?

Where is 2E1?" Some are quite disenchanted to learn that the country is England!

So far, in two years of operating on 50 MHz, I have worked 44 countries in 187 "squares," in 831 SSB QSOs. I have 41 countries confirmed, with 91 "squares," including 9H1, EH6, EH8, EH9, OHØ, OJØ, T7, T9, OY and TF. For the TF, I waited for over an hour. My OM counseled patience—nothing is impossible on six. I finally got the contact and received 5/9 from the IP13 square. Then came the day my husband said, "The band is full of US stations. Get on and work them." I replied that I couldn't work the US on 2.5 W, and went to watch TV. He asked if he could have a go; he went down to the CW end as he normally would, and worked a W3, getting a 339 report. He looked at the front of the rig and saw the word "LOW" underlined—the contact had been made at less than *one* watt. I also learned, to my chagrin, that three of my Novice friends had got across to the US on SSB on six—I should have tried; perhaps next year!

There came a day when I heard "LZ" on six. I kept trying for a contact, and finally realized that I was being ignored. I yelled for my OM; he came running and explained the Novice system, but the LZ could not get the damned prefix. My husband tried to pass my prefix phonetically ... nothing doing. My OM is resourceful, to say the least—he spoke Morse down the microphone, and the LZ got it! A prize QSO for me!

We share the shack; I have it during the day and evening, he goes on after midnight and goes LF DXing on 160, 80, and 40 meters. The wall on his side of the shack is full of amateur radio awards—I guess this is what stimulated me to try to do the same. I have the Radio Society of Great Britain's awards for 50 MHz:

50 MHz Countries Award, 50 MHz DX Certificate—First Novice, 50 MHz Squares Award—First Novice, YO-45-P, and YO-25M.

I am one QSL short of the "Dip Med" Award, and one QSL short of another award—all worked, just hopefully waiting for the QSLs to arrive. The *73 Magazine* "Worked the World" Europe Award was going to be my next award, but unfortunately, it's been discontinued.

My license is Class "B". The Class "A" Novice (prefix 2EØ) has limited HF bands, with the same power limitations—so when you work your first UK Novice on HF or VHF bands, don't yell "Pirate!" Work him (or her) and give that station a little encouragement. I aspire to a higher category of license, but we live in a rural farming community, and license-upgrading courses are few and far between. Perhaps one day ... 73

Number 72 on your Feedback card

New Products

TTE's New Five-Pole Filter

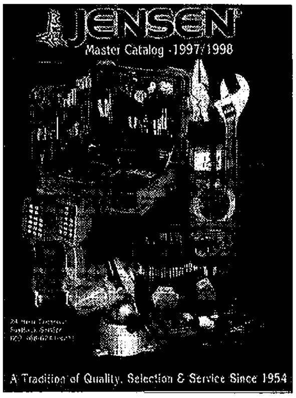
TTE, Incorporated, makers of filters for more than 40 years, introduces their Model 305-1270M-60M. It's an industrial quality five-pole 1296 MHz bandpass filter made with the same materials and processes used in the filters TTE manufactures for the aerospace industry. Each filter has its own serial number, and each shipment is packed with final test data to show that each filter meets all specifications.

Product literature is available; ask for the Ham Radio Department when you call (800) 776-7614 or (310) 478-8224 for information or to order. You can FAX TTE, Incorporated, at (800) 473-2791 or (310) 445-2791; write them at 11652 Olympic Blvd., Los Angeles CA 90064, or [swlsw@tte.com]; check out the Web site at [http://www.tte.com].

Forced to Go to Your Nephew's Ballet Recital?

Tell 'em to stick it in their ear—or, better yet, stick it in your own! The new MFJ-292 Featherweight Earphone/Microphone is so lightweight and unobtrusive you can take it anywhere. A tiny microphone with a push-to-talk switch is built right into the cord. The high-quality dynamic earphone and electret microphone give your handheld crystal-clear audio. If you whisper closely, you can carry on a discreet QSO that won't bother anyone. How many occasions have you sat through, miserably thinking about the contacts you *could* have been making?

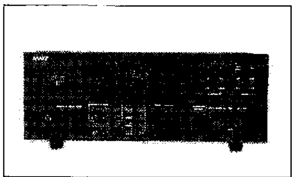
The MFJ-292 comes in three models (I, K, Y) to handle everything from Alinco to Yaesu, and of course it carries MFJ's famous "No Matter What" warranty, and it's only $19.95! For your nearest dealer or to order, call (800) 647-1800; FAX (601) 323-6551; or write to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville MS 39759. Visit the Web site at [http://www.mfjenterprises.com].



Toy Time

Jensen Tools, a subsidiary of The Stanley Works, has been the premier designer and developer of tool kits for the installation, maintenance and repair of electronics equipment since 1954. Their latest catalog features 300 pages of essential items, including a number of test instruments, specialty tools, testers, probes and other devices new to the marketplace. Standard product lines have also been expanded and strengthened to offer customers the widest range of items available.

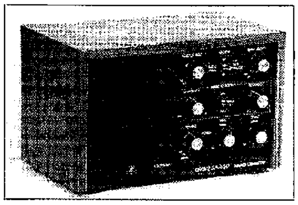
For your free copy of the catalog, call (800) 426-1194 or (602) 968-6241; FAX (800) 366-9662 or (602) 438-1890; E-mail [jensen@stanley-works.com]; or write to Jensen Tools, 7815 S. 46th Street, Phoenix AZ 85004.



Attention, Shortwave Enthusiasts

The R. L. Drake Company has announced the latest in world-band communications technology—the R8B. It's ergonomically designed for easy operation, even for beginners, but it's loaded with features to please the serious hobbyist and expert. The R8B utilizes selectable sideband synchronous detection to ensure signals are received loud and clear. In the AM mode, the selectable sideband synchronous detector provides enhanced reception by eliminating or reducing distortion caused by fading signals. The 100 kHz to 30,000 kHz frequency range allows coverage of all world bands. Additional VHF bands (35–55 MHz and 108–174 MHz), including marine and aircraft bands, are also available with and optional VHF converter.

The R8B's five built-in filter bandwidths ensure reception of most signals under virtually any conditions. A built-in noise blanker minimizes electrical interference; passband offset control minimizes or eliminates adjacent signal interference without compromising maximum intelligibility. A built-in preamp and attentuator also improve reception of extremely weak signals, as well as very strong signals. Yet another built-in feature is the multi-voltage power supply, allowing operation virtually anywhere in the world, and then there's ... well, find out for yourself! Contact the R. L. Drake Company, 230 Industrial Drive, Franklin OH 45005. Call (513) 746-4556; FAX (513) 743-4510; or hit the Web at [http://www.rldrake.com].



What's That Y'Say?

Modern communications equipment and accessories are noted for their poor audio, making listening difficult and fatiguing. Whether your listening interests include scanning, shortwave, ham radio, or even if you need to clean up the audio on another sound system, the Grove SP-200B Sound Enhancer improves sound dramatically, often bringing barely receivable signals out of the background. For privacy, the speaker may be switched off while audio is being monitored via a front-panel headphone jack, or redistributed from a rear-panel jack.

The SP-200B is powered by 12 VDC, and may be operated mobile or from an optional 12 VDC supply. For more information, or to order at its new low price of $199.95 plus shipping, contact Grove Enterprises, Inc., 7540 Highway 64 West, P.O. Box 98, Brasstown NC 28902. Call (800) 438-8155 (US & Canada) or (704) 837-9200; FAX (704) 837-2216; or E-mail them at [order@grove.net].

Photo C. Jack Loflin KC7CGK on the FRG-97 foxhunt course. (Photo by WB6BYU.)

Homing In

Continued from page 63

reports. "The hunt area was two and a half by two kilometers." Scoring was first by number of foxes found and second by elapsed time. Conferring with teammates regarding fox locations was strictly prohibited.

"To win this hunt, one needed not only RDF skills, but strategy, endurance and running speed," says WA7VTD. "Nineteen radio-athletes started in three groups, five minutes apart, with no bearings allowed until a line 100 meters uphill on the mountain trail had been crossed. The temperature hovered at 95° F, with nearly equivalent humidity. Returning to the finish area in time required at least a one-and-a-half-mile mountain trail run, toting RDF gear. Each contestant was given a topographic map of the area. Compasses, but not GPS units, were allowed."

"We started and ended in the park," says WB6BYU. "But most of the transmitters were hidden close to a paved road that curved up by some schools, houses and so forth. One was beside the trail where it came to the road, another next to a soccer field. A third was off the end of a dead-end paved road, up the grass trail. If you got down among the construction equipment there, you could get confused. But if you stayed on the trail, it was right there.

"Everyone used amplitude-based RDF gear," Dale continues. "There were no dual-whip switched-antenna sets. The transmitter carrier was not keyed. The receiver I used has a audio S-meter mode, but I couldn't readily tell which beacon I was DFing in that mode because I got a continuous tone. So I had to keep switching modes. Transmissions were definitely horizontally polarized. Their Mizuho foxes have a turnstile-type antenna.

"I used a home-built three-element yagi. I had plans to make one out of a tape measure, but I ended up making it with welding rod. It has a PVC pipe boom; the elements fit into the pipe for storage. My receiver was taped to the handle below where I hold it. That gave good balance, and a lot less stress on the wrist.

"I have a real good sighting compass, but when plotting on the map, I just eyeballed it. I probably could have had a whole lot more accuracy in my bearings. I never found a transmitter when it was on, it was always just after it went off."

"The terrain was really hilly," says Jack. "There was a good 500 meters of elevation change, so it was a lot different from the area where I was used to hunting. You could either run over the hill to where the transmitters were or run further around the side. I run around home, but I usually don't run up and down hills. On this hunt, I went over the hill at the start. Later I started to search for the beacon transmitter at the finish line with about 15 minutes left, and ended up going back over the hill instead of taking the path that followed the base of the hill. Afterwards, I had to take it easy for about an hour, because I was kind of nauseated.

"I'm pretty familiar with signals bouncing off canyons because we encounter that in the cars," KC7CGK continues. "However, I had never hunted in mountainous terrain with a Russian Altai RDF set. The only experience I had with the Altai was on flat ground. The signals going up the canyons catch you off guard. I had gotten used to just pointing it in one direction and running off."

WA6VTD reports: "By consensus of the multinational judging committee, it was clear that Team Japan won the foxhunt, with the Russians close behind. USA placed third. The old-timers proved by far to be the most competitive. This was the category containing the bulk of the Japanese super-athletes. In fact, the first eight old-timer finishers did better than all contestants in all other categories.

"Despite the intensity of the competition, these were still the Friendship Games," Kevin adds. "So it was not surprising to see WB6BYU offering water to a tired Japanese opponent on the trail or K7KJ buying UAØCDX a soda from a machine located on a road two miles from the start, between two fox sites. In Japan, cold beverage machines are literally everywhere."

"Nobody found all five transmitters," reports WB6BYU. "In the old-timer category, the only person finding the required four did it in about three minutes below the time limit. I was sixth in that category. Coming off the broken ribs, I was just thrilled to finish."

Bigger and better

One sure sign of a successful event is a drive to hold another and to make it bigger. FARS leaders are already investigating possibilities for a new FARS chapter (an Australian group is interested) and they're laying the groundwork for FRG-99, to be held in Portland.

Besides the Tenth Anniversary Jubilee, FRG-99 may become an IARU-sanctioned Region 2 (North and South America) championship. A new ARDF Organizing Task Force has just been formed to work with IARU leadership to set up the necessary committees and protocols to sanction ARDF contests in this part of the world. If this is to happen, preliminary and qualifying events will be needed throughout the western hemisphere to identify future champion radio-athletes.

You can get involved by helping your local radio club sponsor practice and preliminary ARDF events. To find out how to do it, point your Web browser to the "Homing In" site or send E-mail to me. If you're not on the Internet, use the Postal Service. Addresses are at the beginning of this article. 73

Number 75 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Letter time

It's a new year, and here's a new thought about this old segment of the hobby. I received a letter from Jim W8FDV which said, in part:

"I have trouble hearing and have found out that there are other hams with hearing problems who have turned to RTTY. Tune the scope in, read the screen, make the contact."

Truly, that hearing-impaired hams can communicate on the air just as other hams, with and without other impairments, is a tribute to our hobby. I wonder how many such individuals are out there, and how they got started in ham radio. Perhaps some of them could share their stories with us, for inclusion in future "RTTY Loops". Let me hear from you.

It's always nice when I hear about someone getting started in RTTY or digital communications from material printed in this column. Such is the case with Balaji Gopalakrishnan KK7HE/W7YD, who writes:

"I just got started in RTTY after I checked out K7SZL's unofficial Hamcomm home page [www.accessone.com/~tmayhan/]. I built the receive part of a simple interface circuit I got at that site. Right now I am busy with my master's thesis in civil engineering, but once my advisor relaxes I'll start on the transmit part of the interface! I like your column. The thing I liked most was the series of articles you wrote starting August '96 about the basics of RTTY. I don't (or didn't!) know anything about how RTTY worked. One thing I don't like about the interface I built is that it is highly susceptible to noise and QRM. I can build a passive filter, but that would be too bulky and may not be good enough. Might it be possible for you to publish a circuit for an inexpensive audio filter (active)?"

Well, Balaji, I looked around a bit but could not find a simple circuit in any of my references. So, I turn it over to the readership for the latest and greatest out there. Let's see those circuits, folks, and I'll pass along good ones here in the magazine.

After the blurb about the RTTY pix, I enjoyed the comment from another pioneer, Wayne K9SLQ, who reiterated: "Well, Marc, I am sure you would expect a comment from K9SLQ ... The RTTY pix were my favorites. I remember Don WA6PIR well and truly enjoy the old pix. I sure wish I had a disk full of those babies!"

Wayne, I am looking around. The picture files that I still have are either on paper tape, which is rapidly decaying, or on old eight-inch floppy disks that I have long since lost the ability to read. If I can find a source of picture files that can be read by current computers, perhaps we can add some of them to the RTTY Loop Disk Collection. Stay tuned!

Regards as well to Tom KB9IVP, who said: "Marc, I have long since forgotten TTY pictures. I was working at a small police department years ago when they installed the 'new TTY' and we could check records. Wow. Your article reminded me of the many pictures that would be sent to our site. Ah, yes. They were real art. I run RTTY on 14.085 and have regulars I contact in EU. It's fun. Thanks for the memory."

Another RTTY newcomer is Robert Gray, who passes along: "I enjoy your site. I used to use the Universal M7000 to decode some RTTY, but it was pretty discouraging because I couldn't translate about 90% of what I could receive. I have downloaded some of the programs you mentioned and I am going to give it another try, with the help of your Web pages."

Sounds good to me, Robert. There are plenty of programs out there, and they certainly span the gamut from simple and basic to overly complex. We would all be interested in following your adventures in their application.

Speaking of programs for radio teletype, Tom N6XB asked where he could find the program WINRTTY. I searched around and found the site at: [http://people.delphi.com/w5xd/writelog.html].

After checking it out, he wrote: "I am still evaluating some products for RTTY and PACTOR. Hamcomm works surprisingly well, but has no PACTOR mode. I think a good DSP noise filter would help it a lot. Or maybe a good dumb TU with Hamcomm. I am also checking out RITTY, but have not got it running on my notebook computer yet. Next stop is to check out WINRTTY. I want to get something going before the RTTY contest."

Tom also passed along the information that BMK Multy™, mentioned here a few months ago, can be purchased from Schnedler Systems in Florida. I don't have a full address, but that should help.

Not everyone can get into RTTY so easily, though. Barry Maxfield KC7SBQ passes along the following request:

"Being new at the teletype business, and really wanting to succeed at it, I find there is lots of partial or junk information circulating on how to get started

Number 76 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

This month we begin a series put together by Roger Block, president and chief engineer of PolyPhaser Corporation of Minden, Nevada, and his brother Ron Block, owner of W.R. Block and Associates (representatives for PolyPhaser) of Clarksboro, New Jersey. Roger and Ron have done a tremendous amount of research into the whys and wherefores of lightning protection for their commercial customers, but most of their research has equal relevance to our own amateur radio station antenna installations. Lightning doesn't discriminate between amateur or commercial antenna sites—we're all vulnerable! Commercial installations are often located on out-of-the-way mountaintops, so they may have more vulnerability to lightning strikes from that standpoint, but the rolling hill country and flatlands that we hams live in can be equally appealing targets for Mother Nature's fury, when a highly charged thunderhead moves across the sky over our QTH.

Admittedly, not all of the tips and suggestions made by Roger and Ron Block will be applicable to each of us, but the more understanding we have of the mechanics and safe handling of lightning events, the more these suggestions can be incorporated into our own backyard antenna installations. The material to be presented here each month in this series can become a bit involved, from both the technical and ease-of-installation standpoints. I'll do my best to break it down into manageable chunks. If you find that you don't quite understand a certain concept, it may pay to reread it a couple of times, then let it rest for a while, going back to it later for still another reread. I've found this to be a successful approach in my own case when there's a great deal of information to absorb in any complex subject. It usually works. If you'd like to see the original, unabridged version of Roger and Ron's work, contact PolyPhaser Corporation, Customer Service Department, 2225 Park Place, P.O. Box 9000, Minden NV 89423-9000 and ask for their Special Bulletin, "Protection to Keep You Communicating" (copyright 1995). You can also pay a visit to PolyPhaser's home pages on the World Wide Web at: [http://www.polyphaser.com/]. PolyPhaser's Web site also supports text downloads of the original material that's going to be condensed here plus other related texts on the subject. The PolyPhaser Tech Line telephone BBS at (702) 782-6728 is also available to interested readers. The communications parameters are: Data bits—8, Parity—None, Stop bits—1, Baud rate—300 to 14400. If you are dialing in for the first time, the Tech Line requests your name, address and telephone number. You will also need to create a password. Once you've logged on, just follow the menus to navigate around the bulletin board. Many thanks to Roger Block and Ron Block for their kind permission to disseminate the information in this series via *73*'s "Ham To Ham" column.

By the way, this series is not intended to be just one giant ad for PolyPhaser. The fact that it comes from a commercial source, in my own opinion, adds credibility to the tips found throughout the discussion. Roger and Ron have done their homework; you don't get away with selling hype and fairy tales in the commercial communications world ... at least not for very long. If the techniques that the authors will lay out for you weren't effective, word would quickly make the circuit and the business would have disappeared (it's been active since 1979). Commercial customers expect to be served with scientific facts and effective solutions. I'll keep the references to PolyPhaser itself to a minimum, but obviously the name will pop up from time to time. Again, this is not a paid or otherwise compensated advertisement. It's good, sound, proven information that hasn't been disseminated nearly enough in the popular amateur radio press ... until now.

Lightning protection—what your mother never told you!

A National Weather Service survey shows that lightning kills more people annually than

---

in teletype operations. To start, the ARRL handbook offers little information. Then there are Web pages that give tidbits of information, but nothing comprehensive.

"Another problem I seem to run into is the fact that Utah is pretty much an FM state, so the common digital operating mode is packet, which I have no interest in. Therefore there really isn't any local talent to help me get started.

"It seems that here in the west there are few HF operators who operate Baudot. I hear unrecognizable digital modes on the airwaves, but no reassuring chatter of old-time Baudot RTTY. Maybe I'm the only person left in this country who would like to try his hand at nostalgia operating—that is, Baudot and an old-time Model 15 teletype. I wish there were an answer. Then there are other nagging questions that pop into my mind, like why can't my brother, who is a ham, and I operate Baudot RTTY on two meters? This is just one of a hundred questions that go unanswered.

"This list of questions festers in my mind. There are few sources of information on the matter, and since the Elmer system in amateur radio is dying off, there are few people who really can help me find out what I need to know. Any ideas where I might turn to find out about this interesting business? Otherwise, please be gentle when you break the news that the golden days of teletype are over and there are no Baudot operators out there anymore."

First off, Barry, the golden days may be tarnished, but they are not over—not as long as there are interested folks like you around! There is no reason you cannot operate Baudot on VHF AFSK. I was doing it 20 years ago, there are folks doing it today who are not on packet, and you can do it, too. All you need to do is hook up an AFSK generator to the mike input of your transmitter, and go to town. There have been suitable circuits published in this column in past editions.

As for HF, the beauty of HF is that it does not respect state boundaries. Therefore, you are not limited to Utah! Check out 3620 kHz or 14080 kHz for a familiar beedle beedle of 60 wpm FSK. Above all, ask around—I'll bet you can find some action on the airwaves, if you keep your ears open. Give me some follow-up on your successes!

As always, I remain accessible to you all via snail-mail or E-mail.

Check out the "RTTY Loop" Web site, as well, at [http://www2.ari.net/ajr/rtty/] for back columns, RTTY links, downloads, and a full listing of the "RTTY Loop" Disk Collection. Above all, stay in touch—I love hearing from all of you! 73

hurricanes, tornadoes or floods—up to 300 people a year.

More than 100 lightning flashes occur every second in the atmosphere or 8.64 million every day. Fewer than 20% hit the Earth's surface; the rest jump from cloud to cloud.

About 18,000 homes and buildings are damaged yearly by lightning-caused fires. Many more people are killed and injured this way too, but their cases are rarely reported as lightning-related, so they are not included in the lightning statistics.

Deaths and injuries from lightning can be caused by direct strikes, side splash or the spread of ground voltage after the strike. Blood vessels in the head have the least resistance to electrical charge, and strikes frequently result in eye damage. Lightning can also cause paralysis, heart stoppage and other traumas.

The Guinness Book of World Records recorded that a former Shenandoah National Park ranger was struck by lightning seven times and survived. By the way, he lived in Dooms, Virginia.

The concept of lightning protection can be summed up in just a few words: We don't have control over Mother Nature, but we do have quite a bit of control over how a lightning strike's energy is dispersed and dissipated. That's an important point to remember. It means that we can maintain control over the destructive nature of lightning by providing a path to Earth for the strike's energy, and by not simply allowing that energy to choose a random path. Here's another key issue: Building or structural protection is more forgiving than modern-day electronics. A building can handle usually 100,000 volts, while solid-state electronics will often be damaged by just a few volts over the intended safe operating voltage.

The primary rule for protecting your ham radio equipment against damage from a lightning strike is in the interconnection of all of the station elements to a single, low-impedance ground system. Included in this low-impedance ground system are the antenna, the antenna support and all of the input/output lightning protection devices within your system. We'll expand on these points greatly throughout the remainder of the series.

There's an old joke in the real estate business that goes something like this: What are the three most important factors in placing a value on a piece of property? Answer: location, location, location! The same thought applies to an antenna tower's ability to dissipate a lightning strike ... location, location, location. The antenna's location and the effectiveness and location of its planned grounding system will determine how fast and effectively the energy in a lightning bolt will be able to be carried away from the tower structure and dispersed into the surrounding soil and, perhaps most importantly, how much of your expensive electronics will survive.

Here's a picture that you might want to keep in mind: Most lightning strikes will carry huge charges of like polarity. But being of like polarity, those charges will naturally repel each other and want to disperse. The easier the path that you give the lightning charges to disperse in safely, the more likely your equipment will survive the hit. An antenna ground system composed of a number of ground rods, interconnected below grade by large bare radials, will have a better chance of dispersing the strike's energy than a lesser system would have. So the golden rule for surviving a lightning strike is the same no matter which of the many possible variations you may have, i.e., all equipment elements must be connected to a single, low-impedance ground system. This includes the antenna, the antenna support (the pole, the tower, etc.), and all of your station's input and output lightning protectors ... transmission line protectors, power line protectors, telephone line protectors, rotor control cable protectors, etc. By the way, the term radials, as applied here, doesn't refer to the thin wire radials that might normally be used by amateur operators to provide a better "phantom" ground for an HF quarter-wave vertical antenna. When dealing with lightning, don't think small, think big. The radials we're referring to are wide, below-grade copper straps that will be used to help disperse a powerful lightning strike into the Earth's surrounding soil, though they may also contribute to a lowered feedpoint impedance for your HF quarter-wave vertical as a bonus.

Let's examine the significant elements of a good grounding and protection scheme to help you construct a "bulletproof" installation that will have a reasonable chance of surviving a direct lightning strike.

We begin by choosing the antenna's location. This, and the type of antenna, will dictate the size and layout of the earth ground system needed to reasonably disperse the strike's energy. Remember, the faster the ground system is able to spread out and absorb the strike's energy, the better the chances of preventing it from traveling to your equipment. The antenna ground system is part and parcel of the antenna's "location," in the sense that we'll be using that word.

As we'll detail later on, the primary ground system is represented by a set of copperclad ground rods, interconnected below grade, with bare copper radials.

Also fundamental to a good protection scheme is the creation of a single-point ground within the ham shack. This single-point ground will be used to mount all of the I/O protection equipment and to provide a ground for all of the equipment cabinets at the station's operating position. This interior single-point ground is connected to the external ground system (composed of those radials and ground rods) by the lowest-impedance copper strap that you can manage. The tower ground system outside and the single-point ground system inside must be solidly interconnected with a low-impedance metallic strap, so that your coax cable's shield is not the only interconnection conductor between these two ground points. Keeping as much of the lightning's energy off of the coax shield as possible is essential to minimizing damage from a direct hit. For larger strikes, it's best to incorporate a grounding kit prior to the protector, to save your expensive coax connectors from arcing damage. An effective (good quality) coaxial in-line protector can then be used to handle smaller strike currents that may be tempted to travel down the cable itself.

That's all from Roger and Ron Block for this month. Be sure to check back next month for more of their advice on keeping your ham station safe from the devastating effects of a lightning strike ... their series will continue here throughout the rest of this year.

Keep whittling away at it

From Stephen Reynolds NØPOU: "I found myself in need of a special 12-volt DC power cord recently, and not having the exact female end (to match the male connector on the equipment in question), decided to 'whittle the problem down' to match what I did have on hand.

"The connector configuration that I needed is roughly illustrated in **Fig. 1(a).** The configuration of the cord that I had on hand is shown in **Fig. 1(b).** A reasonably short amount of time with a sharp hobby knife provided me with the resultant connector end shown in **Fig. 1(c)** (the dotted outline being the material whittled away).

"With so many different plug configurations showing up on equipment these days, it can often prove useful to keep a small stock of various cords on hand, and whittle away at them when

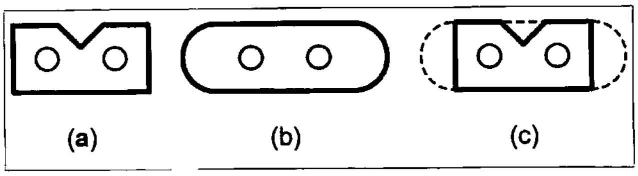


Fig. 1. (a) is the desired end connector shape; (b) is the starting connector; (c) shows how things were whittled into shape.

something special (and unavailable) is needed in a hurry. If the cord is carrying DC voltage, double-, triple-, and even quadruple-check to make sure that you've matched the positive and negative pins on the equipment and the power cord correctly. For AC needs, polarity is generally much less critical. I hope that others will find this approach as useful as I have."

New life for an old drill

From Max Holland W4MEA: "Hate to just throw away your old cordless drill simply because the built-in NiCd batteries have seen better days? Many times it will cost nearly as much to replace the defunct NiCds as it would be to buy a completely new drill ... and you'd still have an old drill! Low-cost cordless drills often have a bad track record when it comes to battery life; the better ones have huskier batteries and generally use more than just a transformer cube and a diode in their charging circuitry. But what can you do with the old drill?

"Why not recycle it (a very '90s thing to do) for use at your workbench, powered from an inexpensive and easy-to-construct dedicated power supply? The motor in your old cordless drill is just a DC motor and it doesn't really care whether its power comes from a battery pack or from a simple AC-to-DC power supply.

"Begin by removing (and recycling at a NiCd battery collection center) the drill's defunct cells, counting the number of NiCd cells used. These drills generally use between 6 VDC and 12 VDC for full power, so 10 NiCd cells would indicate that the motor is roughly rated at the higher 12 VDC figure. NiCds will charge up to 1.4 VDC per cell, but quickly drop to 1.2 volts per cell under load. Their effective charge-life (usable time before recharging) remains fairly constant up to 1.0 VDC per cell, after which they drop toward zero pretty fast (time to stop demanding power from them). So just counting the number of cells and multiplying by 1.2 will give you a close enough voltage rating of the drill's motor (if it's not marked on the motor housing in any way).

"The schematic diagram in **Fig. 2** shows how you can use an easily obtained Radio Shack™ #273-1511, 12-volt, 3-amp transformer (see moderator's note below), along with a #276-1181, 25-amp, 50-volt bridge rectifier unit to whip up an unfiltered cordless drill power supply. You can house the parts, along with a safety fuse holder, in any metal housing that you might have on hand. **Photo A** shows how the one that I made up turned out—certainly close enough for occasional bench work! Connect the negative lead to the rectifier for a 9.6- to 12-volt drill, or connect it to the transformer for a 6- to 7.2-volt unit. If you need a two-speed option for a 9.6- to 12-volt unit, you can simply switch the negative lead between the transformer's center tap and the bridge rectifier's negative terminal for a HI/LO speed option. The switching can be done either at the power supply or in the drill itself if it happens to have a speed selector switch already built into it. A third wire back to the power supply would do the trick in the latter case. Be sure to use a cable from the drill back to power supply that will carry the motor's current safely and stand up to the flexing and kicking around that it might receive on your workbench. That's all there is to it!

"By the way, don't try to utilize any of the parts that were originally supplied with the drill for its charging circuit. They're no doubt rated only for supplying charge current to the battery pack (usually one-tenth of the pack's rated amp-hour capacity), and won't be capable of supplying nearly enough current for the application I'm describing. Stick to the parts described or equivalents from a reliable parts source."

Moderator's note: To be on the safe side, measure the actual current drawn by the DC motor in your own cordless drill before building up the supply shown in

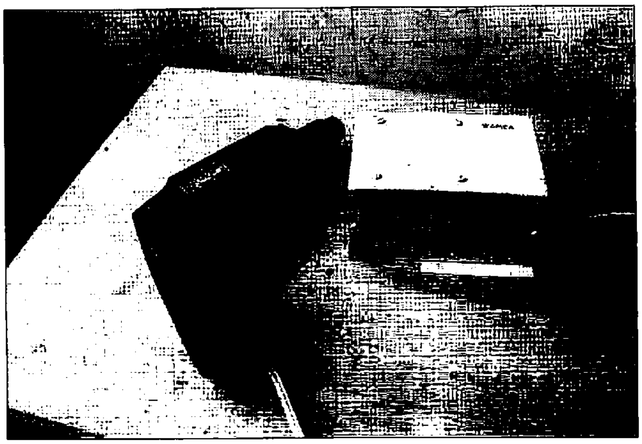


Photo A. *W4MEA's "recycled" cordless drill alongside its homebrew 120 VAC to 12 VDC power supply.*

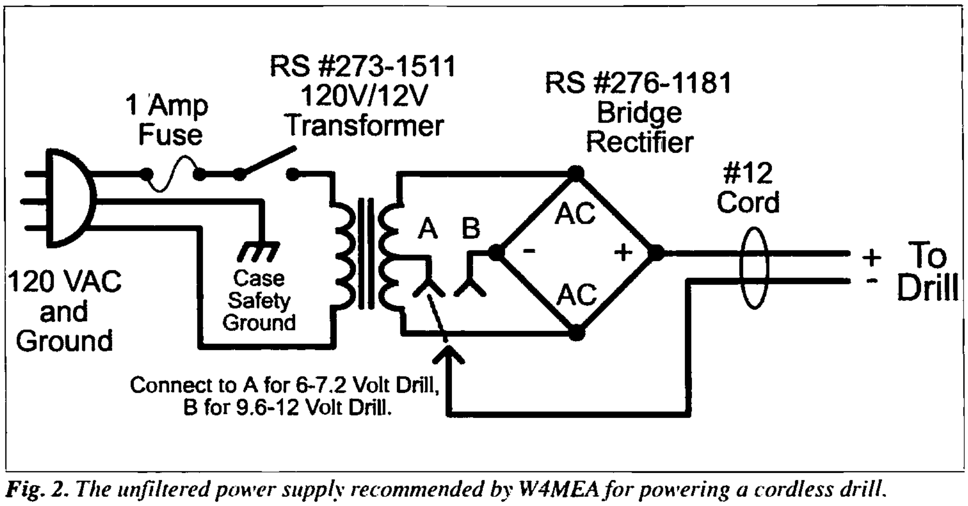


Fig. 2. The unfiltered power supply recommended by W4MEA for powering a cordless drill.

Number 79 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

A bit of random science, a product and a health warning: This month we have another of my "potpourri" columns. One topic covered is "randomness" and why we often mistake randomness for order. We will also look at a new product, and provide a cautionary warning for ham radio and SWL buffs who want to keep their hearing.

What does "random" look like?

We are constantly made aware of random processes. They are all around us. Unfortunately, human beings are wired to reject randomness. Our brains, according to cognitive psychologists, are optimized for pattern recognition to such an extent that we inherently seek patterns—even when there is none. Humans are technically known as *Homo Sapiens*, but *Homo Explainicus* and *Homo Patternicus* are better suited, I think. Why? Because we constantly strive to explain everything and usually make the explanation on the basis of perceived patterns.

One of the problems is that we don't really know what "random" means. If we see what appears to be a pattern, then we focus on that pattern and refuse to see other alternatives. Consider the "coin toss" problem. A coin has two sides: heads and tails. If the coin is a so-called "fair coin," then a large number of flips will reveal that the incidence of "heads" and "tails" is about even. Most coins are "fair" enough that the near 50/50 split between "heads" and "tails" consistently turns up in our tests.

But what if we see five consecutive "heads" come up? Do we assume that the problem is a biased coin? Is the coin tosser somehow making the result come up "heads" rather than "tails"? No! Take a look at **Fig. 1.** This chart records the possible results of coin tosses. At each juncture only two results are possible: heads or tails. It's a random 50/50 binary decision. Only two possible states occur: H or T. Could there be any pattern at all in this project? Note that the trajectory through the table on the far left has five consecutive "heads." Also note that the trajectory on the far right has all "tails." Furthermore, there are several trajectories in which the H/T flip-flop patterns T-H-T-H-T or H-T-H-T-H are possible. These are distinct patterns that suggest non-randomness to the uninformed even though the process that produced them is purely random.

I can't get off this topic without mentioning something that happened to me in college. In the late 1960s I was at Old Dominion College (now University) in Norfolk VA. One comfortably warm late April day a bunch of us were sitting in the Webb Center (student union) lounge area dreading our 2 p.m. calculus class. One wiseguy suggested that we decide what to do by flipping a coin. He drew out a quarter and announced: "Heads we go to the beach, and tails we go (to drink beer) to the King's Head Inn ... and if it stands on end we go to class." He tossed the quarter about two feet in the air, but missed it when it came back down. That coin struck the floor, rolled around in a wide circle about three times and then came to rest *on its edge* against the leg of my chair. That darn "fair coin" wasn't a bit fair to a bunch of lazy EE students.

One of the reasons why people fall for "junk science" so often is that we attempt to find those patterns in purely random events, and then make sense of them. Another thing that leads us astray is that we have an inherent tendency to increase the perceived relevance of evidence that fits our preconceived notions ("sharpening") and decrease the relative importance of disconfirming or contrary evidence. When confronted by two opposing theories we will often over-scrutinize the one that we don't like, while hardly challenging the one we do prefer. That's why scientists use the scientific method to make progress. It is a public, structured way of doing things that minimizes the possibility of error by following procedures and then submitting to the criticism of peers. Junk science is neither structured nor peer reviewed ... and that's why we see so many problems.

SESCOM LAB-x boxes

A couple months ago I mentioned a new series of aluminum boxes by SESCOM, Inc. [2100 Ward Drive, Henderson NV 89015-4249; (702) 565-3400 (voice) or (702) 565-4828

Fig. 2. Some of these little cordless drill motors draw deceptively high currents under load, as much as 10 amps or more!

If you intend to use the drill and bench supply with any of the more power-hungry of the cordless drill motors, the transformer specified in the drawings will probably not be sufficient to meet the necessary current demands of your motor. Higher current 12-volt transformers can be obtained from several of the suppliers who regularly advertise in 73 and would be a better investment.

Murphy's Corollary: Only once all the 18 cabinet screws have been completely replaced will you remember about the blown internal five-amp fuse!

Happy New Year to all our readers and thanks to all this month's contributors:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Stephen Reynolds NØPOU
510 S. 130th Street
Omaha NE 68154

Max Holland W4MEA
7333 Valley Lane
Hixson TN 37343

If you're missing any past columns, you can probably find them at *73's* "Ham To Ham" home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to Dave Miller NZ9E at the address at top of column. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

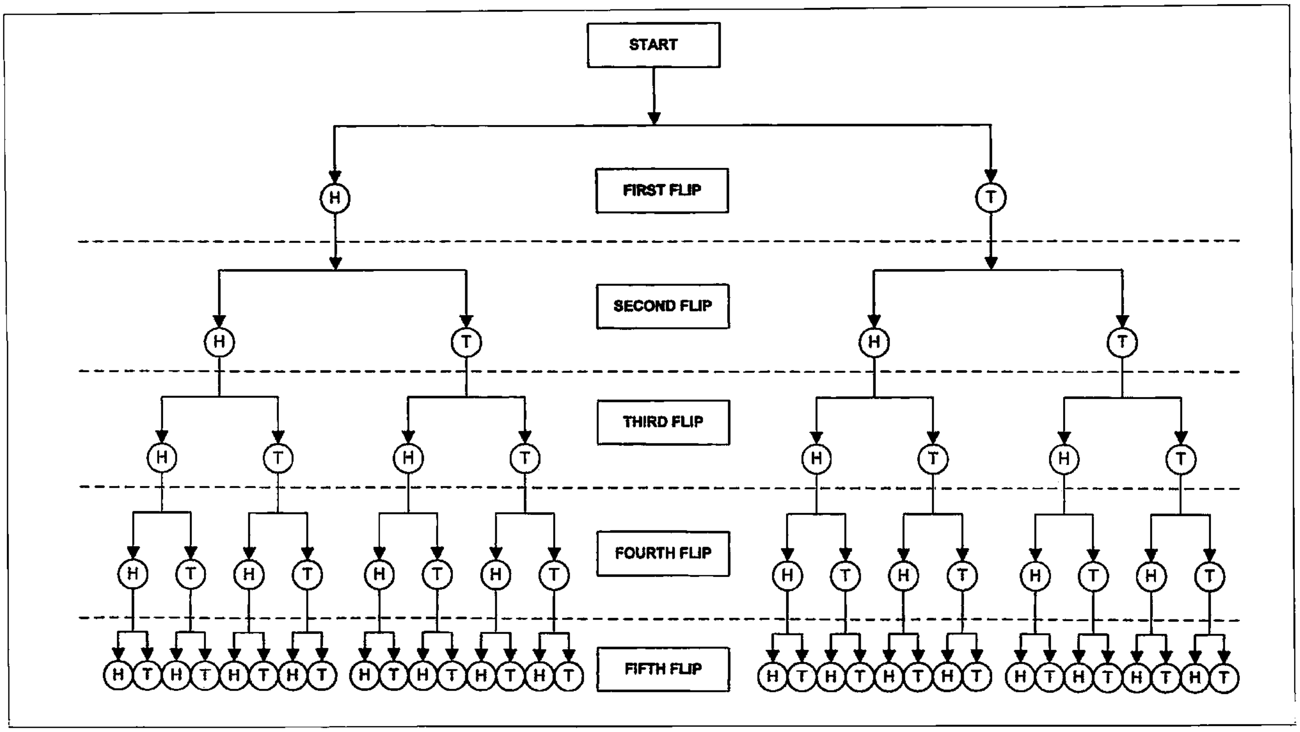


Fig. 1. Coin toss possible results for five flips.

(FAX)]. **Photo A** shows a selection of the boxes from a sample designer's kit provided by SESCOM. The LAB-x series of boxes joins a family of several different types of box that are very useful to the RF and audio project builder. I tested a few of the boxes and found them very easy to put together and use in practical projects.

The widely different pre-punched panels are especially useful. I loathe drilling holes for BNC and SO-239 coaxial connectors, so will prefer to use a pre-punched panel. Even the 0.25-inch hole needed for small-size RCA phono jacks can be accommodated with special SESCOM end panels. If you've ever tried to cut out a DB-9 or DB-25 chassis mount connector you will leap with joy over those pre-cut end panels!

The SESCOM LAB-x series of boxes are constructed from kits using no tools other than a #1 miniature Phillips™ screwdriver (like the little blue Xcelite model).

Photo A. The SESCOM boxes for RF, audio and instrumentation builders.

Caution: Ham radio can be hazardous to your ears!

My right ear has a constant, never-ending ringing that sounds about like a 4 kHz sine wave. Because of it, I never have a quiet day. At night it is particularly bad because there is less interfering noise from the environment, so the ringing sees a more favorable (for it!) signal-to-noise ratio. The ringing started about a year ago. It wasn't constant at first. It would come about once every day or so. But over a period of several weeks it got real damn annoying. So I went to the doctor, who referred me to an ENT ("ear, nose, and throat") doctor.

The ENT doc sent me, in turn, to an audiologist who ran a simple audiogram and found rather bad high-frequency hearing loss in that ear. This is a test where they step through a number of audio frequencies at different amplitudes and you indicate which ones you can hear. The audiologist next ran an evoked potentials test called an "ABR." This test is a variant on "evoked potentials" recordings (which I worked with in engineering grad school). In this test they pick up the patient's EEG (brain waves), while repetitively providing the same tone to each ear in turn for several minutes. When the EEG waves are signal-averaged, the component due to the sound emerges and the rest is filtered out. It was abnormal.

The ENT doc next sent me to have a magnetic resonance imaging (MRI) scan of the brain to rule out an acoustic neuroma tumor. Now that was an experience! It doesn't hurt, but MRIs are aggravating as all getout. The test came back normal. "That's too bad," said the ENT doc. "If there was a tumor, then there's something I could do for you."

We discussed my audio history. In many people my age the cause of ear ringing is 1960s-vintage rock music, which they heard live. But that was not the case because I have despised rock music for many, many

years and have never voluntarily listened to it for more than a few milliseconds (I'm a bluegrass fan). After further questioning, the doctor believes that my problem is due to ham radio.

Yep! Ham radio! The problem stems from the late 1950s and early 1960s when I was operating every day for several hours instead of doing homework (which explains my high school record!). With the receiver audio and RF gains up high, listening for a weak signal through earphones, I would frequently tune across some guy who was about 500 dB above S9, or least much, much stronger than signal I was copying. Either that, or the clown across town running a 2,000-watt loudenboomer linear amplifier into a high gain bandbuster antenna settled right on my frequency without listening first (rude!). I can remember those events causing an almost pleasurable buzz in my right ear. Those experiences caused damage to the cochlea of my inner ear. I asked the ENT doc how this problem could be prevented. Fortunately, the doc was a bit of a techie, and was familiar with ham radio and SWL operations. His advice was:

1. Wear "shooter's earplugs" under the earphones. These earplugs are used by target shooters to prevent ear damage. They have a little piston plunger inside. The plunger stays open at normal sound levels, so you can hear what's going on around you, but snap shut when a high-amplitude sound (like a pistol shot or loudenboomer signal) is received.

2. Wear the earphones a little forward of the ears, so that the ear is not fully covered. This tactic reduces the audio signal power density in the ear canal while still allowing you to hear all but the very weakest, nearly unreadable, signals.

3. Ride the volume and/or RF gain controls so you can instantly knock down the signal level if it gets louder suddenly.

4. Keep the automatic gain control (AGC) on all the time unless there is a good reason to turn it off.

To that I might add:

5. Use the narrowest bandpass filter available that is consistent with the signal you are attempting to copy. This prevents nearby band-crushing signals from causing too much havoc with your ears.

My ham radio mentor, the late Mac Parker W4II, told me exactly the same thing about keeping the earphones a bit ahead of the ears when I was 14 years old. In addition, a number of professional merchant marine radiotelegraphy operators, and a former boss (who was a chief radioman in the World War II US Navy) gave me the same advice. The ol' chief radioman was so badly affected that he had to wear hearing aids. But, dumb kid that I was, I didn't follow the advice of a pair of kindly old gents.

When I left the ENT doc's office, I asked him, "If you can't get rid of the damn ringing, will you at least tune it to the bluegrass station?" 73

SPECIAL EVENTS

Continued from page 49

Exposition Center. A 24 hr., 7 day-a-week phone line is already in operation for vendors and others seeking info. Call *(513) 661-0201*. If you wish to fax the convention, please use *(513) 531-3834*. These lines will inform you regarding vendors, tickets, flea market spaces, and forums. Cincinnati Bell's Answer-Link will allow the appropriate convention staffer to return calls and give the latest information quickly.

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their Hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail [wb8zer@juno.com]*.

SPECIAL EVENT STATIONS

JAN 3–4

MIDDLEBURGH, NY The 3rd Northern New York Section QSO Party will be held Sat., 3 Jan. 0000Z–Sun., 4 Jan. 2359Z. Open to all license classes in any mode allowed by that class. DC to daylight—must be able to communicate at least 1 km and use a minimum of one stage of electronic detection. Terrestrial repeaters are allowed if okayed by the trustee, but courtesy to other users is primary. Repeater contacts during a net operation are not allowed. The use of man-made satellites is discouraged. The goal is to work as many NNY section amateurs in as many of the ten NNY section counties as possible. For more info, send SASE with request for QSO Party rules to *Schoharie County Amateur Radio Assn., WA2ZWM, P.O. Box 1086, Middleburgh NY 12122.*

JAN 10–11

1998 HUNTING LIONS IN THE AIR CONTEST The 26th annual Hunting Lions in the Air Contest will take place 0900 UTC Sat., Jan. 10th–2100 UTC Sun., Jan. 11th, with the objective to create and foster a spirit of international understanding and cooperation among amateurs and Lions, through worldwide communication. The contest is to commemorate the birthday of the founder of Lionism, Melvin Jones, born at Ft. Thomas AZ, USA, on Jan. 13th, 1879. Operators interested in additional info regarding this contest should write to *Contest Committee, Lions Club Flen, Box 106, 642 23 Flen, Sweden; or E-mail [goran.blumentahl@swipnet.se].*

JAN 28

SAN DIEGO, CA The Challenger Middle School ARC, KI6YG, will operate a special event station to commemorate the 12th anniversary of the space shuttle *Challenger* tragedy, 1500 UTC–2400 UTC, on or near 14.250, 21.350, 28.350, and 146.52 simplex. QSL to *Challenger Middle School ARC, 10810 Parkdale Ave., San Diego CA 92126 USA.* 73

NEVER SAY DIE

Continued from page 7

pulse. Our Teletype machines were all upper-case letters, so the 32 combinations allowed by the five pulses were plenty. For numerals and punctuation we had a shift character and they were where you'd normally find capital letters.

Of course it wasn't long before newer Teletype machines were zipping along at 100 wpm throughput, leaving CW even further behind.

With the lid having been blown off the secrecy concerning the UFO crashes, I hope we'll start hearing from more people who have been kept silenced by our government. I recall a recent poll which showed that more than 70% of our people do not trust our government. And with one exposé after another of lies, corruption and cover-ups, it's a wonder that even 30% are trusting. It certainly can't be an informed group.

If you've noticed any sudden technology leaps, how about letting me know about them?

Our country was originally set up as a republic and the Constitution was a well-crafted document. But we've let democracy screw things up—that's where 51% of the people can force 49% to do what they want. And our Supremes have trashed the Constitution, allowing Congress and the President almost free rein to tax and spend, plus the buildup of government to where we have more people working for the government than are manufacturing products.

Grumble.

Art has interviewed a couple of other guys who were involved with the UFOs at Area

51 (Groom Lake NV), Bob Lazarr and David Adair, in addition to the above-mentioned chap, who was afraid to be identified.

Art also interviewed astronaut Mitchell, who said that he believes the government is covering up what it knows about ETs.

Fluorides

Yes, I'm still trying to stop you from poisoning yourself. Or, perhaps it's closer to say letting your government poison you and your family.

And yes, I'm well aware of the promotion fluorides have gotten, and how it's so wonderful for children's teeth that our caring government is putting it into most of our water supplies. So, am I an alarmist, or have I got the facts to back me up?

How about two Chinese studies comparing children in areas with high fluorides in their water with those with low? These studies showed a measurable decrease in IQ for children drinking high-fluoride water. Or a study of 39,000 American schoolchildren from five to 17 years old, which showed that children drinking fluoridated water had almost identical rates of tooth decay compared with those in unfluoridated areas?

Fluoridated water also has been shown to increase hip fractures and bone cancer. Just what you need. In the elderly, which is what you hope to eventually be, a hip fracture is often almost a death sentence.

Distill your drinking water and stop poisoning your body. Just because some companies have found a profitable market for their industrial waste is no reason for you to be sucker enough to drink it.

I don't know if you care how smart your kids are, but will you knowingly help dumb them down?

Oh, are you still using fluoride-laced toothpaste? Just don't swallow any of it. Kids have died doing that.

Killing Your Family

If you are still smoking I'm on your case again. Maybe you've read about the California EPA report that secondhand smoke is killing thousands of people every year? I think of this every time I see a smoker in a car with a defenseless family being forced to slowly poison themselves. There's something about driving that seems to force smokers to light up.

The EPA estimates that secondhand smoke causes 3,000 cases of lung cancer a year in the US, 62,000 heart disease deaths, 2,700 sudden infant deaths, plus asthma, bronchitis in children, low birthweight babies, cervical cancer, and spontaneous abortions.

Prospective employers can easily find out if a job applicant smokes just by getting into his car for a moment. And why should an employer care if an employee smokes? Well, there's the lost working time when they're outside smoking. If they only smoke eight cigarettes during a working a day that's around 80 minutes out of the day, shortchanging the company by 17%. Butt much worse, anyone who obviously cares so little about themselves is not going to be much more interested in the welfare of the company. This is not normally going to be a good worker. As I've mentioned, my worst employee nightmares have been caused by smokers.

Oh yes, smokers are out sick much more than the others, and will run your doctor bills up.

Foreign Aid

You probably haven't been reading much about this beaut, but I have. If you've done any homework on this subject you've been grabbing anyone who would listen and asking them what in hell those stupid idiots in Congress think they are doing with your money.

True, it isn't money out of your pocket. They took care of that problem back during WWII when they tapped your cash directly from your employer, before you even have a chance to see it. They figured that you wouldn't miss something you've never had. But it's *your* money they're having fun with just the same.

Now, about foreign aid. Well, it's not a biggie. So far they've only sent a little over a trillion dollars to other countries. As gifts to other countries. Free gifts. Economists figure that we've managed to do about ten trillion dollars in damage so far.

Despite the fact that there are virtually no success stories, Congress and the giant bureaucracy it has built (and maintains) with your money are continuing to poison one country after another with billions of dollars. The money, of course, doesn't get to the people who need it, just as the billions we've wasted on "fighting poverty" have not helped anyone but the care-givers in our country.

How bad is it? The UN Development Program reported last year that 70 developing countries, all getting US aid, are poorer today than they were in 1980. 43 are worse off than in 1970! The US Agency for International Development (AID) has admitted that hardly any countries receiving aid from us have ever graduated from dependent status.

What happens is that the more money we give to a country, the larger the government bureaucracy they build up to spend it. It doesn't end up helping to build a manufacturing infrastructure, it just supports more and more people shuffling paper. In India, for instance, 70% of the people are government employees. Without foreign aid India would collapse. But as long as the money comes in, free of charge, there's little incentive for foreign governments to make the needed changes.

There's plenty of investment money available to help manufacturing grow. Last year, it's estimated that $244 billion came from private investors. But only Congress is dumb enough to send buckets of money to foreign countries and get nothing in return. Except hatred.

A few years ago I proposed a new kind of foreign aid, one that would not only tend to encourage countries to invest the money for the benefit of all their people, but would end up bringing us a return of many times our investment.

What's the one thing that every country has of value? Even the poorest? Its land. So I proposed that any country that's looking for a handout should sell us some real estate which could be set up as a free trade area the way Hong Kong and Macao were when they were deeded from China. Only none of this "give-back-after-100-years" nonsense.

Okay, Israel, you need more money to support your socialist government-caused inflation? No problem—how about a few thousand acres down by Elat on the Gulf of Aqaba? That would be a great place to set up a new city and banking for the Middle East. Instead of sending Jordan a trailerload of cash every year for being friendly with us, how about swapping a few hundred acres down by Aqaba, down by the border of Saudi Arabia?

Russia is in desperate need of money, so how about slicing off a free zone up there between Russia and Finland?

These little free zones would provide room for our military to have advanced bases that don't depend on the whim of the host country not to throw us out. And it would, as in Hong Kong and Singapore, make it easy for entrepreneurs to start manufacturing businesses—with the knowledge that they wouldn't be harassed by the bureaucracy. We'd protect these areas from hostile neighbors, just as the UK protected Hong Kong.

Opportunity

New technologies, particularly if you get in there early, can make you rich. This was going through my mind as I was inputting the latest Patterson cold fusion patent for the next issue of *Elemental Energy*. The patent shows the construction details of the Patterson Power Cells.

So where's the opportunity? Well, while the energy and power giants are asleep there's one heck of a market out

there for the first products this new technology will provide. How about a small room heating unit that is 150% efficient. Or maybe 1,000%, which seems possible. It would sell like crazy. Maybe a small unit for heating water for your house? It could cut people's electricity or natural gas water heating costs significantly.

Patterson's Clean Energy Technology Inc. (CETI) is interested in working with small manufacturers to start elemental energy products entering the market. How many applications can you think of for small units that will generate heat at about a tenth the cost of using oil? I expect the size and cost of making these units will continue to drop.

So, if you have a small manufacturing company, have a friend with one, or can find one in your area that'll work on contract, get your imagination going. You could end up with a new giant industrial complex in a few years.

Eventually we'll see this low-cost source of energy providing home heat and electricity. Unless scientists come up with a new way of generating electricity from heat, we'll probably be seeing tiny steam turbines being developed which will handle the needs of a home or small business.

These units also can be used, while generating heat, to decontaminate radioactive waste. I suspect that this will eventually be of more interest to the large power companies. Imagine being paid to take the fuel instead of having to buy it! A negative fuel cost as we get rid of the millions of tons of radioactive crud we've been stockpiling and fearing.

Hey, this is not the best time to invest in coal mines or new oil drilling. In a few years we'll see investors selling the OPEC nations short as they crumble. I doubt that any of them have wisely invested their oil billions. Like our major corporations, their minds have been on the next quarter, not the next decade.

What happened to the mainframe computer companies when minicomputers came along is an example. And that was replayed when microcomputers put Wang, DEC, Prime, Data General, etc., on the ropes. The top boys have been having too much fun right now with the money to worry about the future.

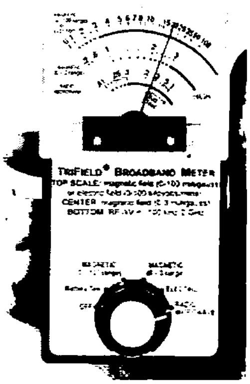
How long will it be before a home power unit will sit there providing heat and electricity for years, drawing its power from a small energy cell made mostly of nickel and using plain water as fuel? Not long.

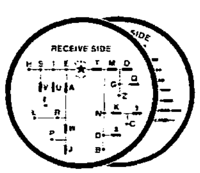
If I weren't so damned busy, and if I had a serious interest in making gobs of money (been there, done that), I'd start looking for small manufacturing firms and get a piece of the action as I got them going with this new technology.

I started from scratch with a new technology I discovered almost 50 years ago and built a manufacturing business with seven subcontracting factories, complete with national distribution. That was when I made my first million. It wasn't long before I had a yacht, two Porsches, an airplane and an Arabian horse. Whee! But somehow I just don't have the drive to do the same things over again. There are too many new things to do. Too many exciting new technologies to look into. So I keep trying to whip you into getting off the couch, away from the TV, or out of your operating chair, and exploring the excitement (and money to be made) with new technologies. 99.9% of the time I've failed, but the letters from the few whom I've inspired keep me going.

Irrelevant?

An E-mail from George Baustert W3BLW suggests that ARRL's National Traffic System (NTS) has largely been replaced by E-mail and is no longer relevant. What do you think? Most emergencies are





dealt with via cell phones and kids these days are on the Web, not the ham bands.

Amateur radio has provided me with a lifetime of adventure and excitement, but the horizons of my youth are gone. The complexity of electronic equipment has made it more and more difficult to build ham equipment, and the loss of our consumer electronics industries to Japan has cut off our supply of parts, even if we did want to build. Not that parts are used for the newer equipment anyway. It's mostly modularized and packed with ICs.

What new modes are there to pioneer? We've done NBFM, SSB, SSTV, repeaters and packet. We've got a bunch of ham satellites up there. but I was making satellite contacts 30 years ago. We were well into Moonbouncing our signals 30 years ago. In 1966 I visited VK3ATN in Australia who was working the US on Moonbounce on 2 m using a bunch of rhombic antennas. I'll never forget working my home station on 20 m (S9+) and then switching to 75 m, where my home station was also coming through S9. Wow!

So, even if the ARRL hadn't cut off the entry of youngsters into the hobby in 1965, we wouldn't have much available for them to pioneer anyway.

If we're not needed any longer for emergencies and we're not getting youngsters interested in electronics careers, and we're of no earthly use to the military in time of war, what is the rationale for amateur radio today? Please advise.

Hydrogen

Okay, I couldn't get you interested in computers 20 years ago, or joining the compact disc revolution ten years ago, or even exploiting cold fusion. Well, Never Say Die, so how about experimenting with a highly efficient way of separating hydrogen from oxygen, thus making hydrogen-driven engines feasible?

I was reading about a new approach, where high voltage pulses (10,000 volts) are put to two stainless steel plates separated by a fraction of an inch (1.5 mm). You need to use very pure water for this, otherwise there will be a low resistance through the water path. The idea is to run milliamperes of current (about 100 mA), and off comes hydrogen and oxygen which can then be burned to make a very hot flame, using a fraction of the energy it normally takes to split the gases from water.

Oh yes, I remember how you snored your way through the article I ran years ago on a legal radar jamming device. Now a bunch of companies are making them and it's a multimillion dollar business. I wouldn't be without one, since almost every police car in NH has a radar unit and speeding tickets are a significant revenue source for our towns.

This new gas generation system has been patented by Stanley Meyer. The usual approach for splitting hydrogen and oxygen from water calls for using low voltage and high current. Some sulfuric acid is used to make the water more conductive. The Meyer system uses pulsed DC, with a rectifier diode, and a detector which shuts off the voltage for a few cycles when the water dielectric between the two plates breaks down, allowing the water to "recover." Observers of the cell in action have been amazed that the cell remains cold, even after making gas for hours.

Meyer claims he's run his converted VW on the hydrogen/oxygen mixture for the last four years using six cylindrical cells. He's stimulating the reactor's gas production by piping in laser light via fiber optics.

You can look over his patents. #4,936,961; 4,826,581; 4,798,661; and 4,613,304 are available from the Commissioner of Patents, Washington DC 20231. Or you can pass up another door of opportunity.

My thanks to the KeelyNet for the above.

Joke

Here's a joke from Walt Bastow W4KVF's *Alligator* newsletter.

One night, a police officer was staking out a particularly rowdy bar for possible violations of the driving-under-the-influence laws. Just about closing time, he saw a fellow stumble out of the bar, trip on the curb, and try his keys on five different cars before he found his car. Then, he sat in the front seat fumbling around with his keys for several minutes. Everyone left the bar and drove off.

Finally, he started his engine and began to pull away. The police officer was waiting for him. He stopped the driver, read him his rights and administered the Breathalyzer test. The results showed a reading of 0.0.

The puzzled officer demanded to know how that could be, whereupon the driver replied, "Tonight, I'm the designated decoy."

Van Allen

In the March 1959 issue of *Scientific American*, James Van Allen wrote an article on "Radiation Belts Around the Earth." He explained that a ship going to the Moon would have to spend about three hours going through the belts, which are about 15,000 miles thick, and start at around 15,000 miles from Earth. His measurements showed the radiation level there varies from 10 to 100 roentgens per hour. 25 rems is considered to be the maximum possible lifetime dose for people.

In 1963 NASA engineers wrote a book stating that even minor solar storms would give people 25 rems per hour through a 1 cm thick aluminum hull.

With an average of 14.8 solar storms per day, the total minimum rem per day in space beyond the Van Allen belt is 369 rem. In 32 hours all living things except cockroaches, some bacteria, and viruses would be dying. This is why John Mauldin, an ex-NASA physicist, wrote in his book that at least six feet of solid shielding would be needed to protect anything living while traveling through space. The LEM hulls were less than .002 inches thick and the command modules weren't much thicker. (Thanks *Cynical News.*)

Shopping

While looking for something in my closet I came across my old crystal ball. I darkened my office and set the ball up on a TV table and took a look into the future.

When I was a kid my mother dragged me by the arm to the department stores downtown. Downtown New York, Philadelphia, and Washington. Then, as cars replaced subways and trolleys, shopping malls and centers appeared, dooming the downtown stores. In the smaller towns it was the supermarkets and WalMarts which decimated the small town stores.

Now we're seeing the beginning of shopping via the Internet. We've been seeing the proliferation of digital communications, with a hefty percentage of phone traffic these days being by FAX and other data transfer systems. This has caught the phone companies by surprise. They've got billions invested in wires going into homes and businesses, connected by wire and fiberoptic cables and slowed down by out-of-date switching equipment. Now they're busy installing newer, higher capacity fiber-optic cables. The day of a wire going into your home will be replaced by wireless systems.

Thus, unless some major catastrophe comes along, I see us heading towards a time when we'll be able to shop via the Web. And we'll be able to get any kind of information we want before we buy. Looking to buy a new car? Well, you'll want to read reviews by several experts. Maybe check out a survey of 10,000 owners to see how they like it. Look at a three-D video showing every feature. Even be able to ask questions of a real person via the Web. Then you can check prices and delivery of your customized model.

You'll be able to do all this from home, or from anywhere you are in the world. Nanotechnology will put the power of a stack of mainframe computers into your pocket.

Ten years ago I watched TV sets being manufactured in Korea, where everything was so automated that each set had less than 15 minutes of people time used from beginning to sitting there on the dock in a carton, ready for shipment. This made for both a more uniform, trouble-free product and for lower costs. Manufacturing in the future is going to require fewer and fewer people. Layers of administration are already being peeled as large firms downsize, with information systems replacing people.

Things are changing. We've already seen the end of lifetime employment and retirement parties for older workers. I don't think they even make pocket watches any more. We're seeing more and more people with cell phones to their ears on the street and in their cars. We're seeing homes with fax machines. We've all got computers on our desks and in our homes. A few already have them in their pockets.

I think it was about 1980 that Sony brought out their Typecorder™. Sherry and I quickly bought a couple of these laptop systems and they went with us on our trips from then on. We used them with modems to communicate between Europe and Asia and home. Then, in 1983, the Radio Shack™ Model 100 arrived. I got one the first day they came out and used it for almost 10 years. Now we take along our Macintosh PowerBooks™, writing on planes, in airport lounges, and in hotels as we travel. They provide us with the Internet, E-mail, and FAXes anywhere we are.

Laptop computers are getting smaller, lighter, faster, and provide more functions.

Keeping this almost inevitable future in mind, what are you doing so you'll be on top of the pack in 10 and 20 years?

One product that's going to be needed is education. It's going to be easy to provide it almost anywhere in the world. Schools will be needed to provide the hardware needed for learning skills, but the top teachers of the world will be available to everyone via high definition video. Anywhere. So I see the decline of universities first and then schools for the lower grades.

Many skills will be taught via simulators, just as we do with pilots today. And we have some very realistic simulators. You can feel the wheels on the runway rumbling along, and the projection out of your cockpit window looks like the real thing—except that with the flip of a switch you're flying in broad daylight, at night, through rain, or in heavy fog.

The same technology can help teach us to drive cars, trucks, buses, boats, and planes. It can teach us to use mechanical tools such as lathes. But it isn't going to teach us to drive a nail or solder a pipe joint. We're still going to need electronics, woodworking, metal working, and other shops, chemistry labs, and so on.

Welcome to the 21st century.

Recovered Memories

You've probably read about the problems that false "recovered memories" have been causing. Wild stories of childhood molestation, contacts with ETs, and so on. Having studied and used hypnosis, all this is no surprise to me.

The subconscious "mind," which is what you're in contact with when you hypnotize someone, is *very* suggestible, and will bend considerably to please the hypnotist. This is the basic reason that there are so many schools of psychiatry. A psychiatrist with a theory has an agenda to prove that theory. His patients easily sense this agenda and fulfill it for the therapist.

It is very difficult as a therapist *not* to suggest things. Therapists start to see what looks like a familiar pattern and the next thing they are suggesting something from the Freud, Horney, Perls, or other "schools." The patient, ever willing to please, confirms it. If the therapist wants ET contacts, he'll get 'em. If he's looking for incest, wow, there it is, complete with lots of lurid details.

Under hypnosis a person's lifetime of memories are easily tapped. These memories are in some way recorded in complete detail and they go right on back into the prenatal period. These are not thinking, conscious memories; they are recorded in some way, and are easily played back. They are not hidden, even though they may be long gone to the person's conscious recall.

When I first ran into prenatal memories I didn't know if they were real or imagined, even though I made every effort not to in any way guide the patient. Out they poured, so I made notes and then later checked with the patient's mother. She was astounded and confirmed that they were real and contained information that there was no other way for the patient to know.

Then I ran into past life memories. When I treated 'em just as I would any present-life trauma, the patients would be cured of the physical or mental problem we were treating. I didn't care if they were real or not, as long as dealing with 'em did the job. I did pursue enough of these recovered memories to get the idea that we've had past lives and the memories of them are there, easy to contact under hypnosis. And that suggests that the recordings of what we've seen, felt and done are somehow stored other than in our physical bodies. Recent studies at several universities have been coming to this same conclusion.

Yes, I've seen patterns. For instance, people who are afraid of the water often jump to past drowning deaths under hypnosis. And erasing the pain from the drowning incident gets rid of the present life problem for them.

We still have a lot to learn about the mind, memories, past lives, and so on. And yes, there are some legitimate recovered memories of childhood molestation and ET contacts.

Quality of Life

How come New Hampshire is one of the fastest growing states in the country? It's the quality of life, and every magazine that's surveyed the subject has come up with the same answer. Our population has grown by 55% in the last 25 years, more like a Sunbelt state. Our lack of a state income tax means that we're able to keep more of what we earn. Our property taxes are high, so though we can keep more of what we earn, if we decide to show off with an expensive home, that costs us. The state gets 61.3% of its revenues from property taxes. It's the only state getting more than 50% of its revenues this way.

We also have much less government than most other states. Vermont, next door, spends 10% more than we do on government. They spend a whole lot more on schools per child and we get better results on standardized tests.

Apparently the long, cold winters, mud season, flying biting insect seasons and roadway-clogging tourist seasons haven't discouraged people from moving here. Mud? I live on a dirt road, so I can testify to the mud in the spring, narrow roads in the winter, with snow piled high on each side, and corduroy in the summer, with clouds of dust following the occasional cars. In October the hotels fill up with fall foliage gawkers. In

January and February it's skiers. In July and August it's vacationers heading for the White Mountains and lake country.

Oh yes, in 1970 our per capita income was $162 below the national average. Now it's $1,800 above.

Getting back to the property tax business, the whole concept irritates the hell out of me. What this means is that the state owns our homes and property and we, in reality, are renting 'em. If we fail to pay the rent we're thrown out. I like the idea of working so I can actually own things, not just be able to rent better things.

Meteors

A card from K1WHS confirmed a 2 m meteor scatter contact with N8XA mobile, who was using a simple 5/8λ vertical antenna on his car and a three-watt Yaesu FT-290R barefoot. Dave was doing most of the work, with his 336-element beam and a kilowatt. I had a similar setup (336-elements and a kilowatt), plus the advantage of a 2,200 foot elevation. I had no problem working HTs in New Jersey and even down to West Virginia. A chap in Hampton (VA) said that even with the worst of conditions my signal was an S-7. With signals like the one from K1WHS you, too, should be looking out for him on meteor scatter and during auroras.

Heartening

I enjoy it when the *New England Journal of Medicine* confirms what I've been preaching vs. what doctors have been saying (and making billions saying it). It turns out that several recent studies have shown that heart attacks and stroke are the result of a lowered immune system rather than cholesterol and high blood pressure. Yes, hypertension and clogged arteries contribute to a lowering of the immune system, which is kept busy trying to clean up the mess your mouth is making of your body. But obviously the other factors which contribute to the weakening of the immune system can't be ignored. Like your not bothering to take supplementary minerals and vitamins to replace those no longer available in our food supply. Like not learning to relax and reduce as much of the stresses of your life as you can. I recommend a good solid daily dose of good music, meditation, and a two mile very brisk walk—in the sun—without wearing your glasses.

You aren't going to choke your arteries with cholesterol if you eat mainly raw fruit and vegetables, which are what your body is designed to process. McDonald's™ should have a skull and crossbones instead of golden arches for their logo. Well, I'm not going to go through all that again, but it's nice to see more scientific studies backing up what I've read in the books reviewed in my *Guide.*

Human nature being what it is, and you presumably being human, I expect you'll nod your head and continue doing as you have until the Great Kahuna (a.k.a. Mother Nature) knocks you on your ass with a brick. Then comes the bypass surgery, which nets the doctors billions and doesn't extend your life or quality of life measurably. Look it up. It's the same with the chemotherapy and radiation treatment scams for cancer. Hey, look it up and see if I'm exaggerating.

Yes, I'm frustrated. I've done a lot of research on how to get over almost any chronic illness and how to extend your life 20-30 years in robust health, but I know you aren't going to pay any attention and are going to suffer and die early as a result. Oh, you'll go for a quick patch for problems you've spent years generating, but making a major change in your diet and habits is asking too much, no matter how big the payoff. Tell me I'm wrong, please?

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

Happy New Year!

Except for the period between the 11th and 19th (which is expected to range from Poor to Very Poor), conditions on the HF bands ought to provide normal seasonal propagation. The northern hemisphere is tilted away from the sun and hours of daylight are less than in spring, summer, and fall. Therefore solar radiation is less, hence UV ionization of the upper atmosphere will be less. That, combined with the low 10 cm solar flux values, will probably produce a rather disappointing month for DXers: fewer band openings and early closings. However, operators using the 160, 80, and 40 meter bands will enjoy low noise levels and around-the-world propagation during hours of darkness.

The chart shows the first ten days and the last ten days to be about as good as one can expect for a January at the beginning of a new solar cycle.

El Niño has been forecast as being the strongest of this century, and weather conditions around the globe may be quite different from "normal" for the next year or two. In particular, the few days centered on mid-January could provide exceptional atmospheric disturbances ... so be prepared!

10–12 meters

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

15–17 meters

DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the US.

20 meters

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

30–40 meters

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

80 meters

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar), and also short-skip during hours of darkness to 1,500 miles or more.

160 meters

Following the usual summertime slump, this band ought to begin to come alive again during the hours of darkness when QRN permits. Try the days marked (G) on the calendar for best results. DX toward the east until midnight, and to other areas afterwards, until dawn. Short-skip to 1,500 miles will prevail when the band is quiet.

Remember to let me know how these forecasts are working for you. Your feedback is much appreciated. W1XU.

JANUARY 1998

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 G	6 G	7 G	8 G	9 G-F	10 F-P
11 P	12 P-VP	13 VP	14 VP-P	15 P	16 P-VP	17 VP
18 VP-P	19 P-F	20 F-G	21 G	22 G	23 G-F	24 F
25 F-G	26 G	27 G	28 G	29 G	30 G-F	31 F

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA									15	15	15	
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

The Good News

Well, there isn't any. The bad news is that the FCC's September new licenses report showed the no-code Techs to be down 42% from last year and down 57% from 1995. The General Class upgrades were down 27% from 1996. 83% of the new licenses were no-code Techs, so there was just a dribble of anything else. I'm not aware that the League is doing anything whatever to change this downward spiral except make it worse by continuing their relentless fight to use the code to keep as many newcomers from coming into the hobby as possible. Well, that's one way to reduce the QRM on our bands. Now we won't have to bother developing new technologies.

Including Ham Radio Fun!

FEBRUARY 1998
ISSUE #449
USA $3.95
CANADA $4.95

International Edition

73® Amateur Radio Today

17m Copper X-Beam
Hey, Try This Delta Loop!
Get Ready for the Big One!
Basic Computer Interfacing

Reviews:
Ten-Tec 2m-to-10m Transverter
Advanced Design's CodeKey
Paddlette Micro Keyer

FEBRUARY 1998
ISSUE #449

73 Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

REVIEWS

HAM RADIO FUN SECTION

On the cover: Solar-powered repeater station VE7RVA was built by the Fraser Valley Amateur Radio Emergency Services Society and sits atop 3,000-foot-high, windswept Sumas Mountain in British Columbia, Canada. Photo courtesy of Will Imanse VE7BID. See article in February 1997 issue.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine. No part of this publication may be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Alarmist

My dictionary says an alarmist is one who is easily or too easily alarmed. I hope, in this case, that I'm an alarmist. This has to do with the recent news articles on Saddam Hussein's concentration on building weapons of mass destruction (called WMDs in the biz). His highest priority seems to be chemical and biological agents (germ warfare). Baghdad denied that Iraq has ever tried to develop biological weapons—until Hussein's son-in-law defected to Jordan and spilled the beans. He then unwisely went back to Iraq and was executed.

We know that Hussein has imported tons of the ingredients for making nerve gas and biologicals. We know that Qaddafi has been making biological weapons. We have no reason not to suspect Syria and Iran of doing the same. We also know that these countries are not only our sworn enemies, but also have a history of supporting terrorism.

One terrorist with a spray can of botulinum toxin, walking through an airport terminal concourse, could infect thousands, including pilots and flight personnel. A few hours later planes will be falling and our hospitals unable to cope.

Then there's smallpox. We know that several unfriendly governments have this beaut. Historically, 30% of the people infected die a miserable, painful death. That's the 30% with the weakest immune systems. Have you been keeping yours at industrial strength, or will you be one of the first to go?

Once smallpox had been eradicated almost 20 years ago they stopped vaccinating people against it, so a few aerosol sprays in public places could trigger a plague which could kill millions. There isn't enough vaccine left to vaccinate more than about 3% of our population, so we'd have to quarantine any infected areas and wait to see who survives.

If something like this happens there's going to be a big demand for two things. One will be communications, and two will be Bioelectrifiers to clean the virus or microbes from the blood. Say, have you built one yet? Or are you going to wait for that sudden announcement on TV some night that terrorists have just struck Manhattan, Washington and Chicago? Any old Boy Scouts out there who feel the need to Be Prepared? I was in Troop 34 when I was a kid.

If anthrax or any other agents are suddenly used I know I'm going to be glad I have my immune system going strong, and backed up by a Bioelectrifier, just in case, to keep it strong.

If Iraq, Iran, Libya, Syria, or the Serbs decide to attack us, what are we going to do in return, atomize their countries? Not likely. Or is it? By coincidence, several prophets, who have remarkable success records, are predicting a third world war to kick off in the next year or two.

Hey, just dismiss me as Chicken Little so you won't miss watching Monday Night Football.

But, just in case, how are you set for emergency power? Will your local repeater operate without commercial power? Is your HT in good shape? Does your club have an emergency van that can communicate with other emergency and government services?

I might point out that my non-alarmist record is pretty good. I didn't suck in on the global warming or cooling campaigns, nor the ozone hole scare, nor the awful dangers of increased CO_2 in the air. I've explained the who and why of the Freon™ and CFC hoaxes. How many of these bogus "scientific" scares did you buy?

But I am concerned about the potential for terrorists to unleash chemicals or biological agents which could do one heck of a job on us, or they might even end up setting off one of those missing Russian suitcase nuclear bombs in downtown Manhattan.

Though I disagree with almost everything Clinton does, I do hope they don't nuke Washington, considering Clinton's Gore insurance. Just as Quayle served to protect Bush from assassination attempts, I suspect Gore could be doing the same for Clinton.

It's De Bunk

Oh, the horror. Oh, the humanity! Just remember the media agonizing over the meltdown at Chernobyl. I don't recall any of the TV "news" shows or magazines putting the accident into perspective. Scientists added up the pluses and minuses, reporting that during its 25 months of life Chernobyl Unit 4 saved far more lives from coal-fired pollution than it took (or will ever take) by radiation.

Okay, so much for that hysteria, now let's tackle that pesky ozone hole which is threatening to expand and douse us all with lethal ultraviolet rays. It turns out that those scientists not looking for grant money assure us that historical records show that the ozone layer is self-healing and that most of the chlorine which reaches the stratosphere comes from natural sources. Note that the dread ozone hole has been appearing over the south pole, far away from the wicked CFC polluters, not in the much nearer Arctic.

It's estimated that the world's industry produces about 750,000 tons of chlorine per year. The Mt. Erebus volcano in the Antarctic puts out 1000 tons every day.

Global Warming?

Well then, how about global warming? Yep, the carbon dioxide is increasing in our atmosphere, but historically there's been no link between CO_2 and world temperatures. What it does do is increase the growth of trees, which have increased by 25% in this century. Just read the Dixie Lee Ray book, which is reviewed in my *Guide*.

As I pointed out in a recent editorial, complete with a photo, the ice buildup at the poles has been increasing, not melting. According to Dr. Zwally of NASA the ice caps have been accelerating in their growth and are now increasing by about eight inches a year. That's an area over twice that of the US, so that isn't trivial.

Canada's glaciers are growing too. They're larger now than any time in the last 60,000 years, according to Dr. Miller of the University

of Colorado. And it's the same in Alaska, Norway and around the world.

What's doing all this? If you're interested in understanding the ice age cycle from a scientific view, you'll want to invest in Robert Felix's *Not By Fire, But By Ice*. It's an easy (well, I should say uneasy, if apocalyptic threats tend to make you nervous) read. It's $16 from Sugarhouse Publishing, Box 435, Bellevue WA 98009; (800) 310-1764, ISBN 0-9648746-9-5, 256pp.

It turns out that every time the Earth's magnetic field reverses all hell breaks loose. Felix points out that there are at least a couple thousand underwater volcanoes in the Pacific Ocean and that recent reports show that more and more of them are recently active and pouring 2150° basalt into the ocean. Gee, you don't suppose this could have any connection to the recent record high temperatures in the Pacific we call *El Niño*? Nah.

It turns out that ice ages don't gradually happen. They're so sudden that they have been responsible for endless mass extinctions. They wiped out the dinosaurs a few million years ago and the woolly mammoths just recently (11,500 years ago). It flash-froze them with flowers still in their mouths. Slowly-frozen meat rots. The mammoths were frozen so quickly their meat is fit to eat today when they're defrosted.

They recently had 21 inches of rain in one day in California. If it had been a little cooler that could have been 210 inches of snow. That's 17.5 feet! You don't dig your way out of anything like that. You put on your snowshoes and climb out a third-story window. Hmm, there aren't very many three-story homes in California, are there? Too bad.

But it couldn't snow in Southern California, could it? How about the recent unseasonable snows that covered Colorado and the whole Midwest? Then there was the Blizzard of '96, which smothered the East Coast, a record. In July 1996 snow fell in parts of South Africa and France. We're seeing record floods and unseasonable snow storms while the environmentalists are fretting about global warming.

Looking at the historical record as found in tree rings, the geological dating of earth layers and ocean core samples it turns out that ice ages start in an amazingly short time and are coincident with the precession of the Earth as it wobbles on its axis. Felix says that this 11,500-year event causes a reversal of the Earth's magnetic field which, in turn, triggers the eruption of thousands of volcanoes along the tectonic plate edges, 80% of which are under the oceans. The resulting warming of the water then causes more evaporation of the oceans into the atmosphere, where it falls as snow on the polar areas, bringing on a new ice age instead of global warming. Greenland is already getting six feet of new snow a year and Antarctica has recently been getting 18 feet!

The end result will be a growing ice pack which will cover a good deal of the US and a drastic lowering of the oceans. And all this could be well along in the next 20 years.

The most recent USDA charts of what crops can be grown where clearly show the Earth cooling. Farmers in the Dakotas and Minnesota are already changing to hardier crops. It won't be long before wheat won't grow fast enough to be planted as the seasons get shorter and shorter, so they're changing to rye. We could have some major food shortages in the next few years, and it isn't going to get better.

Of course Felix may be wrong, but he sure has the weight of historical research on his side.

Gordon-Michael Scallion K1BWC is predicting the same massive volcanic eruptions, but he's seeing the warmer ocean as melting the polar ice, thus raising the sea level around 250 feet or so, making major changes in the map of the world. Either way, all this mayhem is predicted to start happening in the immediate future. Hold tight and keep your emergency gear up to snuff.

A Thousand Volcanoes?

Why, I wondered, would a reversal of the Earth's magnetic field cause volcanoes to start erupting? René theorizes that the flow of salt water in the ocean through the Earth's magnetic field generates enormous amounts of current in the surface of the Earth and this results in the making of volcanoes. He explained how this works in his *The Last Skeptic of Science*, where he and a friend set up an experiment using two large carbon electrodes and a welding power supply. They were trying to make diamonds by running an electric current through a carbon-based powder.

When they turned on the power the powder heated up and after a couple of days they had a miniature volcano erupting. They turned off the power, but it kept right on going and they had a tough time smothering it. Later they sent out the resulting magma to a lab for analysis. Nothing in the original mix had an atomic weight over 20, yet the assay came back with elements as high as bismuth (83), which is heavier than lead. Read the book for the details.

So here we'll have the same result, but on a world scale. Then the volcanic heat warms the oceans, changing the ocean currents, which generates even more electrical current. It's the perturbation of the magnetic field by the Earth's wobble, coupled with the magnetic fields generated by the solar flares as the sunspots shower the Earth with high electrical currents (which we can see as the aurora), that creates the instability. We

LETTERS

From the Ham Shack

Michael R. Borer WL7CKB, Anchorage AK. Dear Wayne, I read the Henry Ruh KB9FO article with great interest and enthusiasm, and had to sit down and respond. I believe that Mr. Ruh has a very good idea, and has obviously spent a great deal of time thinking this out, but in a number of instances he has taken some good ideas to a ridiculous extent. Mr. Ruh seems to have forgotten a very important salient point: Amateur radio has been, is currently, and will continue to be, as long as we have the spectrum, a *hobby!* Hobby, as defined in the *Oxford Modern English Dictionary*, is "a favorite leisure-time activity or occupation." What Mr. Ruh is proposing is just a more complicated and expensive ARRL system, though his suggestions, in my opinion, have a lot more merit than the current system.

Mr. Ruh seems to be attempting to force everyone into a single mold, instead of allowing each individual to choose his or her own way, as befits their interests. This is tantamount to telling artists that they must paint portraits or still lifes when their interests lie with scenes and landscapes. Or to tell a philatelist that he will collect 19th century English stamps, when his interests lie in North American areas. Mr. Ruh, with his suggestions, is continuing to promulgate the "contest mentality" that encourages one to notch his microphone with as many contacts as possible, like the Old West gunslingers who cut a notch in their pistol grips for each kill. Now please don't get me wrong, I am not against contests, I'm just not interested, as I'm sure others are. I guess that I just prefer rag-chewing to racking up numbers.

He is also continuing to promulgate the "religion of the key," CW. Again, though I am not advocating a total discontinuance of this mode of communication, he seems to be placing an undue amount of importance on an outdated, outmoded, overglorified means of communication.

I, for one, am not interested in wallpapering my radio room with all of the awards that the various amateur organizations promote, even though I do enjoy collecting QSLs. So far, most of his suggestions for a better licensing system have eliminated most chances for advancement for me, for one. And what about the hams who either are not interested in advancement, or who don't want to go beyond the "Adventurer" class? According to Mr. Ruh, it seems that he is proposing an ultimatum: Either advance or get out. Again I must remind Mr. Ruh that amateur radio is a hobby, and unlike a job or profession, where one must continue to advance so as to receive a larger paycheck, a hobby, and this one in particular, does not accept any remuneration. Therefore, if people are happy where they are, why should they be forced to do things that they don't have any interest in doing?

One other rather salient objection to some of Mr. Ruh's proposals—those primarily concerning long distance VHF contacts, and attending various hamfests. What about those of us who live in Alaska or Hawaii, and must span thousands of miles to make a single contact out of our states, on VHF? Yes there are occasional 6 m openings that allow for limited contacts, but in over two years of monitoring 2 m SSB, I have yet to hear anything outside my own state. Yes, I know that there is always satellite communication, but that does require quite an investment, not only in money and equipment, but in the space to use it, which for some urban dwellers can be even more difficult to obtain than that required for some HF bands. And as to attending all those hamfests, with the extended travel requirements just to arrive "out there" (the Lower 48, in my case), a person could go bankrupt just in airline charges alone.

You might conclude, from my criticisms, that I found little to no merit in Mr. Ruh's suggestions, but that could not be further from the truth. I wholeheartedly congratulate Mr. Ruh on this, his work in progress. I find a lot of merit in his proposals, and I laud the "rough draft" and encourage him to keep up the good work, to network with other current amateurs, and to try to incorporate a multitude of other ideas. I realize that my ideas and opinions do not necessarily represent the ideas and opinions of others.

But from my narrow-minded point of view, I firmly believe there is some merit in my suggestions or objections, and there may be something that can be taken from this to improve Mr. Ruh's plan, or at least to make it more palatable to a greater majority of currently licensed amateurs.

Philip Ingraham W2OSY. In a span of 64 years it has been my privilege to visit the vast regions of our Arctic and Antarctic. I have had pleasant conversations with many citizens of a large majority of all countries. I have discussed world affairs with world leaders, ship captains, the rich, the poor and the humble as well as the famous. I have been where there was disaster, and in a small measure, tried to help those involved.

My friends out there have never questioned me as to my status, education or dislikes—just friendly conversation as over the backyard fence with a neighbor whom they considered a friend. I witnessed the birth and rise of the vacuum tube as well as its demise. More recently, the electronic miracles are difficult for an 81-year-old to follow and work with. It is my belief that ham radio will never die. The young will respond to its never-ending thrill as I did when I first smelled the odor from a hot vacuum tube, the energy from which helped me to visit far off places. Oh yes, things will be somewhat different. Change is the only permanent thing we have. All is perspective—the result is change.

---

know that sunspots and weather changes are coupled. What we don't have a record of is the combination of the effects of Earth's precession and sunspots.

Both Scallion and Felix are predicting massive ocean warming from volcanoes. Scallion figures the warmer oceans will melt the polar ice, raising the oceans, and Felix says the polar ice is going to grow into another ice age, lowering the oceans several hundred feet. René proposes that the lopsided buildup of ice at the poles will cause the Earth itself to suddenly move the poles to the tropics, quickly melting the old polar ice, and that new polar ice will build up in what used to be the tropics.

Unless they're all wrong, we'll know who is right in a year or two. But any of the three scenarios is likely to wipe out a few billion people.

Past ice ages have been sudden, with several wiping out 90% or more of all life. Mass extinctions. The geological records are clear—these have happened many times.

Richard Noone in *5/5/2000* is also predicting doom for us. He proposes that the Earth's crust can slip, and this is likely to happen when all the planets line up on May 5,

Continued on page 43

QRX . . .

Number 8 on your Feedback card

FAR Scholarships Available

The Foundation for Amateur Radio, Inc. (FAR), a non-profit organization with headquarters in Washington DC, plans to administer 66 scholarships for the academic year 1998–1999 to assist licensed radio amateurs. The Foundation, composed of over 75 local area amateur radio clubs, fully funds nine of the scholarships with the income from grants and its annual Hamfest. The remaining 57 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from $500 to $2500, with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs, especially those in Delaware, Florida, Maryland, New Jersey, Ohio, Pennsylvania, Texas, Virginia, and Wisconsin, are encouraged to announce these opportunities at their meetings, in their club newsletters, during training classes, on their nets and on their World Wide Web home pages.

Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 1998, from:

FAR Scholarships
6903 Rhode Island Avenue
College Park MD 20740.

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(C)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purposes of the Amateur Radio Service.

Hams to the Rescue!

On November 22, 1997, three students from Franklin Pierce College, in Rindge, New Hampshire, went for a hike. That in itself is not unusual. These three young men, however, decided to hike up 3,165-foot Mount Monadnock, In Jaffrey, New Hampshire. They began their climb around 3:00 in the afternoon. The weather ceiling was down to about 2,000 feet, which meant the top third of the mountain was obscured by clouds. Nightfall would be at 4:19 p.m., and winters in New Hampshire can be ... well, wintry.

One of the students, a licensed ham from New York State, carried a small two-way radio. By 6:15 p.m. they were ready to concede that they were lost, and called for help. They were completely disoriented In the snowy darkness, they had no compass or matches, and their only flashlight battery was failing (it went out at 9:37 p.m.).

The heroes of what could have been a tragic misadventure were two New Hampshire women and a repeater known as "Henry, the Keene Machine," a reference to the nearby city of Keene, New Hampshire. Henry (K1TQY/RPT), situated on Hyland Hill in Westmoreland, 15 miles from Mount Monadnock, picked up the students' distress call and relayed it to others in Cheshire County. Henry's trustee, Dawn Cummings K1TQY, immediately took charge of communications. Roberta Bennett N1WTY of Jaffrey telephoned the emergency information to Monadnock State Park Manager Michael M. Walsh, then drove to Walsh's office at the base of the mountain with her two-way radio and her young son N1XZE.

For the next four hours the ladies and Henry provided the link between the hapless, increasingly miserable students and the search party. Walsh, himself hampered by darkness and inclement weather, was able to give the students instructions and encouragement as he worked his way to their position.

The students were found at 11:03 p.m.

Amateur radio has often been dismissed as outdated and unnecessary, but those three grateful students and their loved ones can testify to its importance in emergencies.

Those New Forms

As of January 1, 1998, amateur radio license applicants may only submit FCC Forms 610, 610A and 610B that carry an edition date of September 1997. Previous editions of Form 610 will not be accepted for filing by the FCC or by Volunteer Examiner Coordinators (VECs).

The major change on the new form is a certification to the effect that the applicant has "read and will comply with Section 97.13(c) of the Commission's Rules" regarding RF radiation safety and the amateur service section of OST/OET Bulletin No. 65, Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

Section 97.13(c) says that before you transmit "from any place where the operation of the station could cause human exposure to RF electromagnetic field levels in excess of those allowed," you must perform an RF environmental evaluation if your transmitter PEP exceeds the following limits.

160–40 meters: 500 W
30 meters: 425 W
20 meters: 225 W
17 meters: 125 W
15 meters: 100 W
12 meters: 75 W
10 meters: 50 W
VHF (all bands): 50 W
70 cm: 70 W
33 cm: 150 W
23 cm: 200 W
13 cm: 250 W
SHF/EHF (all bands): 250 W

If the routine environmental evaluation indicates that the RF electromagnetic fields could exceed the maximum permissible exposure limits, you must take action to prevent human exposure.

The new 610 forms may be obtained from the FCC Web site [http://www.fcc.gov/formpage.html], or by FAX at (202) 418-0177 (request index, or: for Form 610, use form code 000610; for Form 610A, use form code 006101; for Form 610B, use form code 006102). The FCC Forms Distribution Center will accept FCC forms orders at (800) 418-3676.

Individuals may also get copies from the ARRL (225 Main St., Newington CT 06111) by sending an SASE with 32 cents postage for each Form 610 requested.

CW Forever

You must have, at times, thought into the past,
Where some things go out, while others last,
What comes to my mind is the Old Morse Code,
That has weathered the storms from any abode.

To talk with one's fingers is surely an art,
Of any info you care to impart,
In most conditions the signals get through,
While the same about phone is simply not true.

Those dits and dahs cut through the trash,
Of nearby noise or lightning's crash,
To the sensitive ears of the ham receiver,
Who records this data with ardent fever.

He knows he's doing something unique ...
(In such poor conditions, that's quite a feat!)
To roger the message that came off the air,
These brass pounders sure do have that flair.

They say Morse ops are a dying breed,
But don't despair, there's always that need,
That when conditions get rough for the new automation,
Rest assured, there'll be a need for your station.

CW is dying? Believe it never,
This mode will be 'round forever and ever,
But one thing is sure, what we really need,
Is to relay our knowledge to the younger breed.

To carry the torch, long after we're gone,
To send Morse Code through the air like a song,
When at last, Silent Keys pull that final lever,
We can rest in peace—it's CW forever.

By WA1TBY, TNX W8WFB, in the Dixie Amateur Radio Club May 1997 newsletter.

Attention, Teslaphiles!

You may recall articles by John Wagner W8AHB urging more recognition of Nikola Tesla and his contributions to science—*73* published one in our January 1996 issue, and a followup in June 1996. In our "Letters" department in the August 1996 issue, Bernard S. Finn of the Smithsonian replied in detail to Mr. Wagner's articles. Interested readers may wish to look up those issues; it would be simpler, though, to check out the Web site at [http://www.concentric.net/~jwwagner]. T-shirts celebrating Tesla's life and works are also available in adult sizes (S, M, L, XL, $20, and XXL, $22, postpaid). Make checks payable to Dexter Community Schools and mail to John W. Wagner, 3890 Tubbs Road, Ann Arbor MI 48103-9437. All proceeds go toward the casting of museum-quality bronze busts of Tesla to donate to leading universities.

Hamvention and Hara Arena Sign Landmark Agreement

On Wednesday, November 12, 1997, Hamvention General Chairman Richard Miller N8CBU and Hara President Johnny Walker signed a contract to hold Dayton Hamvention at the Hara Complex through the year 2003. This is the longest contract in their business relationship.

Dayton Hamvention is responsible for adding over $7 million annually to the Dayton economy. This will translate to over $35 million over the contract.

In the year 2000 the Dayton Hamvention will be the site of the American Radio Relay League National Convention. The Dayton Hamvention will hold its 50th in the year 2001. It will also play an important part in the "2003 Celebration, the 100th Anniversary of Powered Flight" in honor of the Wright Brothers.

The Dayton Hamvention has been working with local businesses and the community to improve the 1998 event, to be held May 15–17.

From the *RF-Carrier*, official newsletter of the Dayton Amateur Radio Assn., December 1997.

CIRCLE 68 ON READER SERVICE CARD

Wouldn't You Really Rather Drive A BUIC?

The Basic Universal Interface Circuit ties your computer to your rig. Part 1: hardware.

L. VanProoyen K8KWD
8330 Myers Lake NE
Rockford MI 49341

My wife recently made me an offer I couldn't refuse: "Get that dump you call a ham shack cleaned up—or else!" Since then, I've been trying to simplify the configuration of my radio equipment to eliminate clutter (wires and boxes all over the place). One area of clutter that came to my attention was my computer interfaces. Since I frequently use a computer connected to one or more of my radios, I wanted to streamline the interconnecting cables and equipment needed to do this. Because my equipment lineup tends to change from time to time, I began looking for a single "universal" means of interfacing my computer to whatever radio I happened to have (or be using) at the time.

It seems that most radios, ICOM and Kenwood types notably, provide a computer interface at TTL levels—whereas most computers since the Commodore 64 include only an RS-232 level interface for serial communications. To connect my computer generally requires an interface unit of some kind, and these are boxes that sit around and may require additional lines for operating power, etc. This all adds to my clutter problem. I see that some of the newest radios are starting to include direct RS-232 connectivity, but most still need outboard hardware. This article is a description of how I solved my clutter problem with an easy-to-build, inexpensive, in-line, computer-powered interface that will work with most ICOM or Kenwood radios of recent vintage—and could, with minor modifications, also be used with others. I have also included information about software requirements, including sample program listings, to show how easy and fun it is to experiment with radio computer control.

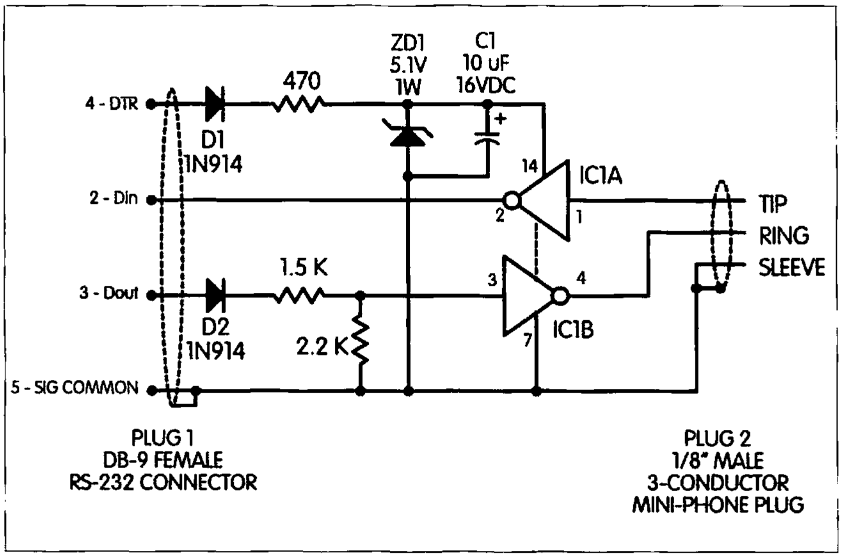


Fig. 1. The universal RS-232/TTL level converter basic circuit. All resistors 1/4 W, 10%.

The basic interface

While similar in the general requirement, namely conversion and inversion of RS-232 levels to TTL, ICOM's

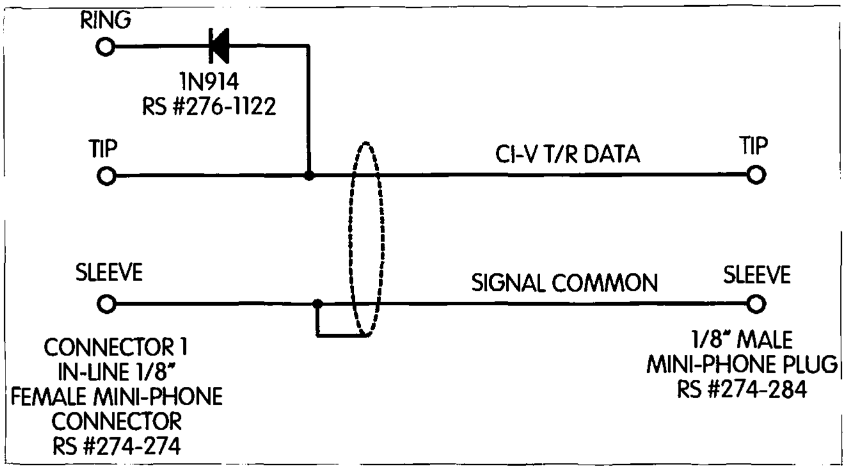


Fig. 2. The ICOM CI-V adapter cable circuit.

CI-V interface differs considerably from that used in various Kenwood radios. ICOM's CI-V data interface is a single transmit/receive data line, while Kenwood uses the more traditional separate TxD/RxD lines for computer communications. There are also considerable differences in the specifics on how the software needs to work between these types of radios, but more on that later. **Fig. 1** is the circuit I finally developed, and its design was driven largely by the criteria of keeping it simple and using locally available parts. **Fig. 2** is the circuit I use as an ICOM adapter cable, and **Fig. 3**, a Kenwood adapter cable. **Photo C** shows the complete in-line assembly.

The heart of the circuit is a 74HCT04 hex-inverter chip stocked by Radio Shack™ stores (among others) nationwide and selling (at this writing) for 89 cents. I chose this CMOS implementation of the standard 7404 TTL chip because of its high speed and low current characteristics, and its tolerance for abuse despite being marked as a static-sensitive device. I have previously used this chip in several applications other than the one described here and never had a failure, even after hitting the inputs with more than 15 VDC, or accidentally using a source supply near the same value. Also, I have not found a need to use special "static-sensitive" handling precautions with this chip; the interface circuit for this article was constructed by soldering interconnecting wiring and components directly to the chip's leads. (**Photo B** shows the basic interface circuit.) I would recommend using an IC socket, however, to reduce the risk of zapping the chip during construction. Use of a socket also makes changing the chip much easier should it surprise us and fail prematurely.

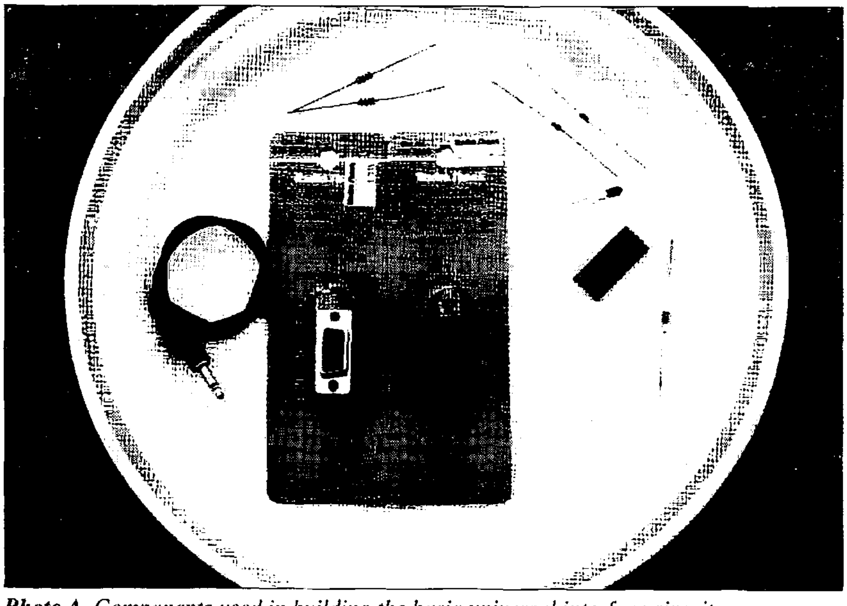


Photo A. *Components used in building the basic universal interface circuit.*

Circuit notes

I decided to do a three-wire RS-232 implementation even though the Kenwoods support hardware handshaking (RTS and CTS). The main reason I did this was the availability of a two-circuit in-line phone connector that enabled me to keep it an "in-line" device. Since I used a hex-inverter chip for the basic interface, this leaves four unused gates that could be used to carry CTS and RTS between the radio and computer, if your primary interest is for Kenwood radio applications. **Fig. 4** shows a possible means of conveying these signals via the basic interface circuit should you wish to implement this. Incorporating the details of **Fig. 4** will require using cables with more wires than I used and coming up with some other scheme for connecting the radio interface cable (e.g., wiring the Kenwood DIN connector directly to the basic interface circuit), but it may be worth it if you intend to use some commercial software products, as many of these require these hardware handshake signals.

The circuit is powered using the computer's data terminal ready (DTR) line. This signal sits at some negative voltage when off and changes to +10 VDC or more when active, depending on the computer. I used a series diode (1N914) to prevent reverse polarity powering the chip during periods when DTR is off, and I used a series dropping resistor (470 Ω in my case) and zener diode regulator (5.1 volts) to complete the "power supply" for the interface. Most computers supply the

various RS-232 control signals to work into a 2 kΩ to 5 kΩ load, so there may be some voltage sag when using this line as a power source, but the CMOS chip's draw is negligible. If your computer's DTR line runs much higher than +10 volts, the 470 Ω resistor may have to be changed to 1 k or so.

My computer's RS-232 levels (I use a Compaq™ notebook for my radio stuff) vary between ±10 volts, so I designed the interface around a +10 volt supply. Since my computer is battery-operated a lot of the time, its RS-232 levels often drop to seven volts or so as the battery discharges. This does not seem to affect proper operation of the interface. To keep the computer D_{out} line level within reason at the chip's input, I used another series diode (1N914) together with a voltage divider made up of a 1.5 kΩ and 2.2 kΩ resistor. If your RS-232 level is much greater than eight to nine volts, it may be advisable to increase the 1.5 kΩ value. As mentioned earlier, the 74HCT04 seems quite tolerant of minor overloads.

The DIN line to the computer as produced by this interface circuit is not exactly RS-232 specification in that the signal never goes negative. Most computer RS-232 inputs look at anything less than +2 volts as an indeterminate level, however, and declare the input false. I've tested this circuit in this application at 19,200 baud with several computers and never experienced a problem, and I've also used similar circuits in other applications at baud rates of 56 k and found this scheme to work fine.

The ICOM adapter

Circuit details for the ICOM adapter are shown in **Fig. 2**. It consists of a three-conductor in-line female mini-phone connector that mates with the basic interface unit's male connector. There is a 1N914 "signal combiner" diode installed at this connector, which serves to allow (conduct) sinking the CI-V line following data on the Radio Data In line from the basic interface circuit. It also allows the CI-V line to sink the Radio Data Out line without having to also sink the Radio Data In line, which it wouldn't otherwise be able to do, being a relatively high impedance source. **Photo D** shows this diode installed at the connector.

ICOM's CI-V interface can support up to four radios. Should you wish to connect additional radios to this system, simply daisy-chain additional 1/8-inch CI-V plugs to the one at the adapter and run them to your other ICOM rigs.

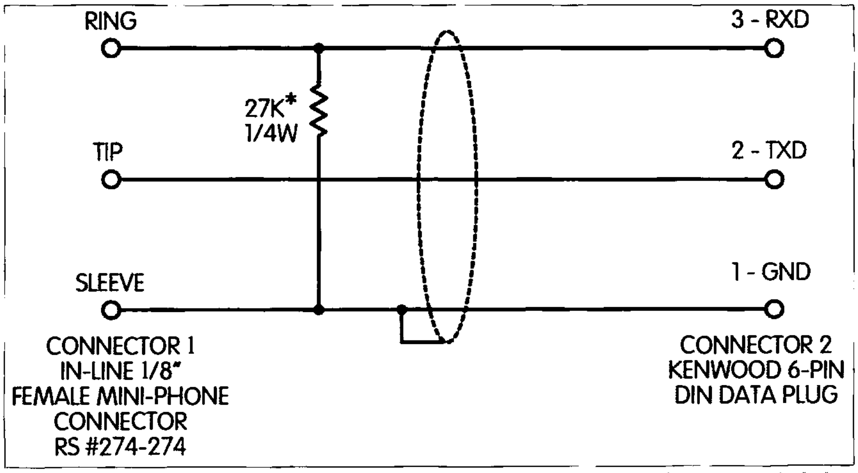


*Fig. 3. The Kenwood adapter circuit. *Use of this resistor is optional. It was included to make basic circuit (and radio) less susceptible to static charges.*

The Kenwood adapter

The Kenwood adapter is basically a connector adapter cable that takes signals from the three-conductor plug used with the basic adapter and pipes them to the appropriate pins of the six-pin DIN connector used with many Kenwood radios for computer interface connections. The single trick in building this adapter will be getting the right DIN connector, but if one can not be found locally, it can be obtained directly from Kenwood. **Photo E** shows an adapter I made up together with a variation I've used with the TS-50 in which I "pushed" the insulated wires directly onto the pins of the rig's CN-6 connector (located inside the radio on the bottom circuit board). I included a 27 kΩ resistor in my Kenwood adapter cable, mounted at the three-conductor connector as a precautionary load to reduce the risk of static discharge damage should the cable be hot connected. Use of this resistor is probably not necessary, but I tend to be somewhat conservative about these things. Many Kenwood rigs include a 10 kΩ load on their TxD line internally.

Construction

Component layout is not at all critical when building this circuit, so I built mine to fit inside a half-inch-diameter piece of tubing I had. Tubing like I used is available at most hardware stores in a variety of sizes. I usually buy it by the foot.

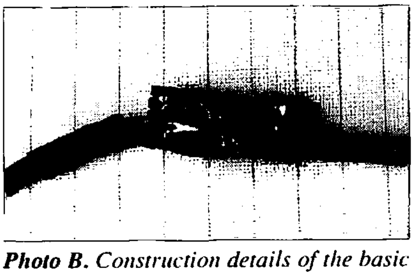


***Photo B.** Construction details of the basic universal interface circuit.*

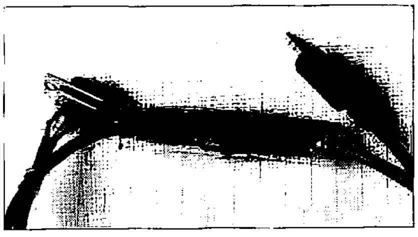


***Photo C.** The complete basic interface assembly is shown protected by a section of plastic tubing. Tie-wraps looped through slits in the tubing and around the cables ensure mechanical integrity of the assembly.*

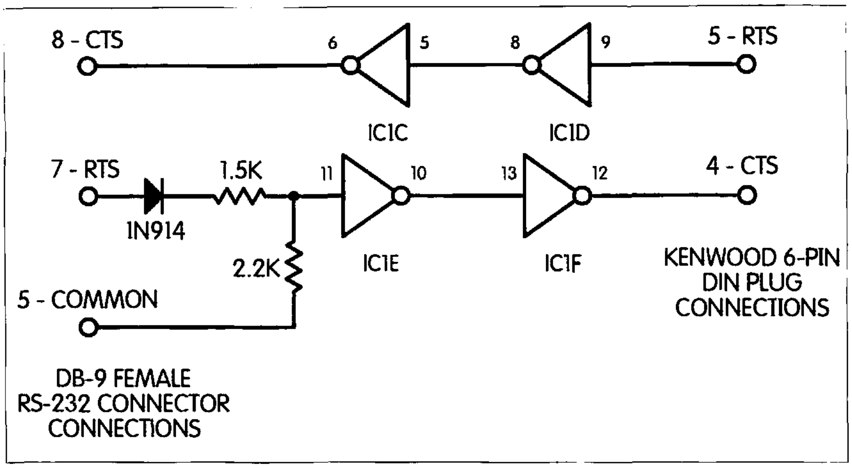


Fig. 4. Additions to the basic circuit to accommodate RTS/CTS control for Kenwood applications. Many commercial software programs for Kenwoods require hardware handshaking to work properly.

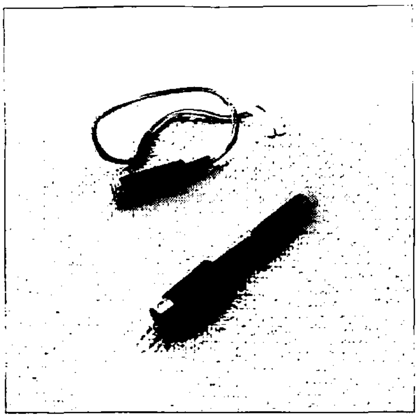


Photo E. *Kenwood adapters for the basic universal interface circuit. The top adapter is used with a TS-50 by "pushing" the wire ends on to the pins of CN-6 (the TS-50's interface connector). The bottom one is essentially a plug adapter for Kenwood radios that use DIN-type interface connectors.*

In keeping with a "low profile" approach, I elected not to use a socket for the IC, opting to solder directly to its pins sticking through the perfboard "chassis." Similarly, I attached the input/output cables by directly soldering the cable leads to their connection points on the perfboard chassis. I would recommend using an IC socket. Input and output are misnomers for these cables, by the way, since both cables are actually bidirectional.

I used a point-to-point wiring technique, with insulated jumpers to connect the various "points," as required. After assembly and test, I slipped the plastic tubing over the circuit assembly. I then secured the two cables to the tubing using tie-wraps looped through 1/8-inch slits I had cut into the tubing using an X-Acto™ knife. This provides good strain relief for the cables and results in a neat and durable cable assembly (see **Photo** C).

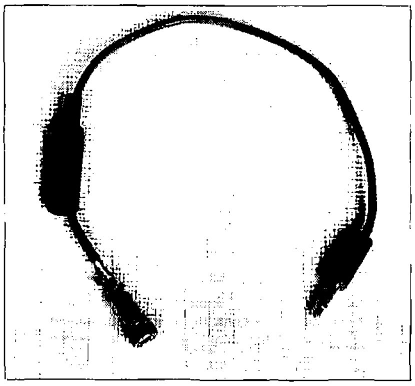


Photo D. *Construction details of the ICOM CI-V adapter showing the 1N914 diode mounted inside the three-conductor 1/8-inch phone connector.*

Since RS-232 lines tend to be noisy, I recommend using shielded cables for this application. I used a four-conductor cable for my run between the computer's RS-232 port and the interface circuit and a two-conductor shielded cable from the interface circuit to the two-circuit 1/8-inch phone plug.

I connected the shield of the four-conductor cable, at the RS-232 connector end, to one of the four wires (a green wire in my case). I let the shield float at the interface board end, and used the (green) ground wire (only) to connect to the interface board. Use of suitable ferrite beads over the cables might be necessary should you notice an objectionable amount of noise. I didn't have any problem with my setup.

Preliminary tests

Before connecting this cable assembly to anything, I would recommend making a few ohmmeter checks. First, I suggest checking continuity between signal ground (RS-232 connector, pin 5) and the sleeve of the 1/8-inch plug. 0.2 Ω or less would seem appropriate for this. For this test and those following, it is assumed that you're using a nine-pin RS-232 connector. If you're using a 25-pin type, you should translate the referenced pin numbers accordingly.

Next, I would check resistance between signal ground (RS-232, pin 5) and pins 2 and 4, respectively. Typically, you should see 100 Ω or more here.

If your ohmmeter can't supply much current (typical of FET-type meters), use the diode-check function if you have one; otherwise, these tests may be inconclusive. Generally, what you're looking for is an obviously unusual reading that would be indicative of some wiring error.

Finally, I suggest checking from the tip and ring of the 1/8-inch plug to all wired RS-232 pins. You should typically see readings greater than 50 kΩ. Any reading of less than 15 kΩ would be reason for suspicion here. Also, I generally use an ohmmeter to check ICs pin by pin for possible shorts.

After making the resistance checks, I would suggest powering up your radio and plugging the CI-V plug into the radio *only* (assuming you have built the ICOM adapter and have an ICOM radio). A short circuit here won't hurt anything, but a 90-volt spike might! Once connected, check the voltage at the CI-V plug tip. You should see approximately +5 volts if all is OK.

If everything is checking out thus far, it's time to see if the circuit is working. To do this, you'll need some communications software. I used the terminal program packaged with Windows™, but any terminal program should work as long as you configure it correctly and it brings up DTR. I configured for COM1, 9600 baud, eight bits, and software flow control. Kenwood radios typically run at 4800 baud, so if you have a Kenwood, I'm afraid you'll have to wait for the section next time describing Kenwood's software.

As a quick check with the terminal program, typing "FA" should generate a reply from the radio if all is working. The remaining paragraphs in this section deal with checking out the CI-V interface operation with an ICOM radio—a trickier process than checking out a Kenwood.

With ICOM radios, I generally configure the CI-V port address for 48 h (my IC-706's address), auto baud, and transceive enabled. Some older ICOMs may not offer auto baud, and if this is the case, you will have to reconfigure both the software and the radio for a matching baud rate they both support. Once configured and connected, you can test to see if you are receiving data by giving your radio's VFO knob a spin. Data will appear on your screen as gibberish since it is binary in nature, but the point of this test is to simply confirm that data is getting through.

Should this test fail, I suggest checking voltages. You should see +5 volts at the CI-V plug tip (plugged into the radio and the radio on), +10 volts at DTR, -10 volts at TxD, and near zero at RxD. If you don't have DTR, for example, you might try another communications program, because you need DTR to get the rest.

Verifying that the interface can send data is a little trickier, but at this point, you can test functionality by monitoring the +5 volts at the CI-V plug tip (remember, it must be plugged into the radio because the radio sources this five volts).

While watching the meter, hit a computer key. You should see a slight flicker in the +5 volts each time you hit a key. A scope will show the +5 volts dumping, if you happen to have one and are ambitious enough to pull it out and connect it up.

At this point, if the interface appears to be functional, continuing checkout requires selection of one of two options. You may elect to use a commercial software package designed for ICOM radio control, or you may want to experiment with developing your own. Some custom software is required, unfortunately, because writing and reading data to and from ICOM radios involves sending and decoding little data "packets." Next time: software.

Parts List

C1	10 µF 16 VDC tantalum (RS #272-1436)
D1, D2	1N914 diode (RS #276-1122)
IC1	74HCT04 hex inverter (RS #276-2804)
Plug 1	DB-9 female connector (RS #276-1538)
Plug 2	1/8" male 3-cond. mini-phone plug (RS #274-284)
ZD1	5.1 V, 1 W zener (RS #276-565)

Table 1. Parts list.

Tutorial and Tester for JFETs

Big learning from a little project.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

When you want to design with a JFET and have only data sheet characteristics, you're in a bind for critical information. The data sheets for JFETs may be close enough for device selection but not close enough for design. Data sheets often show characteristic spreads of five or 10 to one and don't give "typical" values. Of course, you can assume that the typical value is the average of the maximum and minimum values and hope the transistor in your hand is typical.

That's a lot of assuming. It would be comforting to know what you're actually working with. This tester measures forward transconductance g_{fs} and drain current I_D for either N-channel or P-channel depletion-mode JFETs.

Forward transconductance g_{fs} is an AC characteristic, the change in drain current I_D for a change in gate-source voltage V_{gs}. The drain current is a DC characteristic, I_D vs. V_{gs}. The relationships of JFET characteristics are given in equations in later paragraphs. Suffice it to say that g_{fs} is a function of I_D, and when I_D is maximum, g_{fs} is maximum.

Note that g_{fs} is a critical parameter because it must be known to calculate the gain of an amplifier, which is $A_v = R_l g_{fs}$, where R_l is the drain load resistance.

The operating point is defined by I_D and V_{gs}. The resistor needed to produce the desired source bias voltage can be calculated with the equation $R_s = V_{gs}/I_D$, where V_{gs} is the gate to source voltage and I_D is the drain current corresponding to V_{gs}.

The JFET tester has three sections: 1) a test signal generator; 2) a measurement circuit; and 3) power supplies. The test signal, a 1 kHz 0.2 V_{p-p} square-wave, exercises the device under test (DUT). The measurement circuitry converts the square-wave output of the DUT to a DC voltage that is proportional to g_{fs}. The power supplies provide unregulated but low ripple +15 V and -15 V for the DUT, the op amps in U2, and +8 V (regulated) for the oscillator.

The test signal generator shown in **Fig. 1** uses two sections of a CMOS CD4001 NOR gate U1 connected as inverters for the oscillator. Any two CMOS inverters can be used. For example, two sections of either a CD4011 or CD4009 will work equally well. The frequency of oscillation is determined by R1 and C1, $f_o \approx 1.2R1C1$. R2 just limits the current in the input protection circuit of U1A. R1, R2, and C1 can be 10% tolerance parts. The frequency of the test signal is not critical, but its amplitude is. The output swings from V_{DD} to V_{EE}. Therefore, the V_{DD} voltage applied to U1 must be regulated to produce a constant-amplitude test signal. V_{DD} is arbitrarily chosen to be +8 V and the output swings from +8 V to 0 V. The 8 V_{p-p} output of the oscillator is divided by R3, R4, and R5 to produce a 0.2 V_{p-p} signal and a 0.1 V_{p-p} signal. If a different V_{DD} is used, the values of the resistors used in the divider must be changed. The test signal applied to the DUT must swing from 0 V to -0.2 V for N-channel JFETs and from 0 V to +0.2 V for P-channel devices. Level shifting of the divided oscillator output required for different polarity devices is accomplished in U2A. When the +0.2 V signal is applied to the inverting input of U2A, the output swings from 0V to -0.2 V. The divider is loaded by the inverting input of U2A in series with R6. This loading must be taken into consideration when calculating the values of R3, R4, and R5. The inverting gain is set by the ratio R7/R6. The noninverting gain is 1+R7/R6; therefore, when the inverting gain is unity the noninverting gain is two. When the 0.1 V signal is applied to the noninverting input, the output is 0 V to

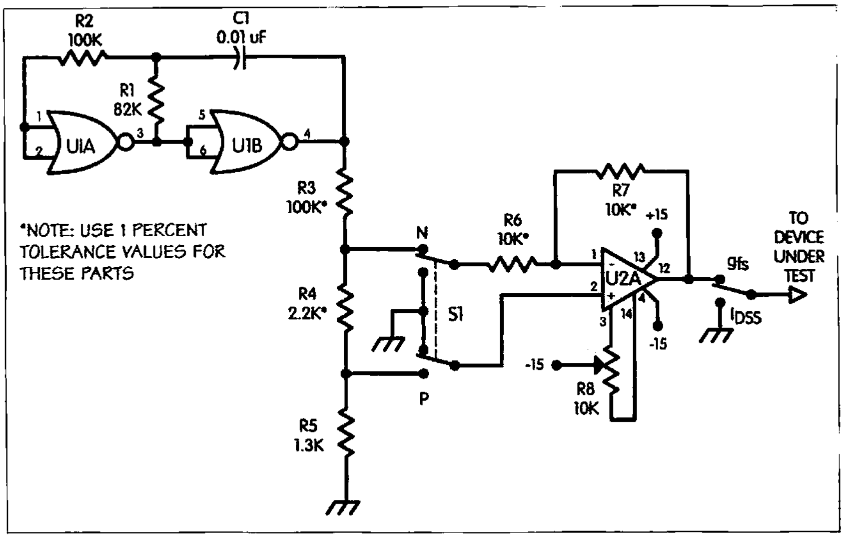


Fig. 1. The test signal generator produces 0 V to +0.2 V_p or 0 V to -0.2 V_p.

+0.2 V. The noninverting amplifier input resistance is very high and does not load the divider. Since the input to the DUT must be very close to 0.2 V, the resistors R3 through R7 should be 1% tolerance parts (commercial equivalents to RN55DXXXF). The 10 kΩ pot R8 nulls the offset of U2A. Adjust R8 for zero at the output of U2A when the input is zero—that is, when the junction of R3 and R4 is grounded.

The square-wave test signal at the gate of the DUT swings from 0 V to 0.2 V. This implies an average (DC) value of 0.1 V. Therefore, the indicated value of g_{fs} is the g_{fs} when V_{gs} = 0.1 V. The gate current is a few picoamps when the gate is reverse-biased (negative for an N-channel device, positive for a P-channel) but rises rapidly when forward-biased. The input signal to an amplifier should not drive the gate positive, but for maximum g_{fs}, the peak of the signal should drive V_{gs} to just zero.

The DUT and metering circuit is shown in **Fig. 2.** The square-wave test signal (output of U2A) is applied to the gate of the DUT. The output of the DUT is capacitively-coupled to the precision rectifier U2B to eliminate any DC component. The output of the DUT is rectified to produce a DC voltage that is proportional to g_{fs}R9 of the DUT. The DC voltage at the output of the precision rectifier can be measured with an internal voltmeter, or a bench voltmeter can be used in J2 (Radio Shack #274-252) to save the cost of panel meters. The resistance of the voltmeter need not be high; a 1 kΩ/V basic analog movement is acceptable. However, the resolution and readability of a digital multimeter (DMM) is a definite advantage. A current meter in the insulated shorting jack J1 (Radio Shack #274-255) allows a bench milliammeter to indicate I_D. At first glance it would appear that the current meter could be placed from source to ground, but the typical 25 mV voltage drop across the meter would be significant when compared to the 100 mV DC component of the input.

The drain load R9 of the DUT is chosen to be 200 Ω to ensure sufficient drain-source voltage even when the drain current approaches 50 mA. The minimum drain-source voltage V_{DS} must be greater than "pinch-off" for measurement of meaningful g_{fs}. "Pinch-off" is the V_{gs} necessary to put the DUT in the constant-current operating region. For long-channel JFETs, "pinch-off" is about V_{off}. For short-channel devices, pinch-off V_{off} is higher, but most devices pinch-off with less than 8 V gate to source.

The gain of the DUT and the precision rectifier is scaled to produce a DC output of 1 V when g_{fs} is 1 mS (1000 μmhos). The gain of the DUT is 0.2 when the gfs is 1 mS: A = 1 x 10^{-3} x 200 = 0.2. The capacitively-coupled 1 kHz input to the precision rectifier is a square-wave that swings from +20 mV to -20 mV when the DUT's g_{fs} is 1 mS. The precision rectifier has a gain of 50 and the output is +1 V_{DC} when the input is +20 mV_p. The gain of the precision rectifier is set by the ratio R13/(R11+R12). R12 limits the range of gain adjustment from 31 to 94. The adjustment of gain is a one-time procedure that compensates for errors in the

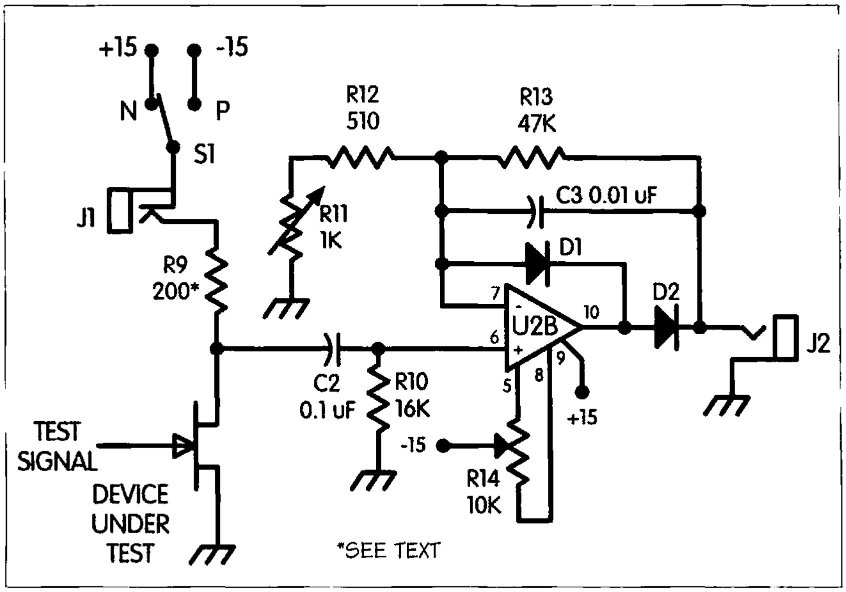


Fig. 2. The measurement circuit output indicates I_D and g_{fs}.

tolerances of R9, R12, and R13. The diodes D1 and D2 should be switching diodes similar to the 1N4148 or 1N914.

U2 is shown as an MC1747 (dual 741 op amps) but any general-purpose internally-compensated op amp can be used. The input offsets of the 741 are specified as 5 mV voltage offset and 200 nA current offset maximum at 25°C. These offsets can produce a DC output in excess of 250 mV unless they are nulled out. The 741 has provision for nulling the offsets with an external trimmer pots (R8 in **Fig. 1** and R14 in **Fig. 2**).

Adjustment of the tester is straightforward and only needs to be performed once:

1) Null the offsets of U2A: Connect a jumper from the junction of R3 and R4 to ground and adjust the trimmer R8 to zero the output of U2A.

2) Null the offsets of U2B: Without a DUT in the socket, adjust R14 to just produce zero at the output J2. Note that the output of U2B can not be driven negative so the adjustment must be for the output to be just zero.

3) Set the gain of the precision rectifier. Connect a jumper between the gate and drain terminals of the empty DUT socket to apply the output of U2A (0.1 V_p) directly to the drain terminal. Adjust R11 to produce 5 V on the voltmeter at J2. That's it.

To use the tester, turn off the power, plug the voltmeter into J2, select the polarity of the DUT with S1, plug the JFET in the socket, and turn on the power. The voltmeter in J2 will indicate 1 V for g_{fs} = 1 mS. A milliammeter in J1 indicates I_D at V_{gs} = 0.1 V. Close S2 and the current meter in J1 indicates I_{DSS}. In passing, be aware that a JFET can operate with drain and source interchanged and not all JFETs have the same pinouts. While most JFET pinouts have the gate at pin 3, some have the gate at pin 2. Pins are numbered from left to right looking at the flat side of a TO-92 package.

The power supply for the tester shown in **Fig. 3** provides +15 V for N-channel JFETs, -15 V for P-channel JFETs, and ±15 V for U2.

The actual voltages are not critical. Anything greater than 12 V will do, but 15 V provides a little more headroom for a high-current DUT. The ripple on the voltage applied to the DUT must be low, because the metering circuit has little discrimination between the 1 kHz test signal and the 120 Hz ripple. The V_{DD} for the oscillator is critical in that it determines the amplitude of the test signal. A regulated +8 V ± 5% for the oscillator is provided by U3, a 78L08AC three-terminal positive voltage regulator. The power supply shown can provide more than 50 mA with peak-to-peak ripple less than 1 mV_{p-p}, but a DUT drawing 50 mA may cause V_{DS} to fall below pinch-off—in which case gfs will be indicated a little bit high.

The power supply shown uses a Radio Shack 25.2 VCT transformer, #273-1366, to produce 17 V_p. A 24 V center-tapped power transformer will produce about 16 V. D3 and D4 form a positive full-wave rectifier, while D5 and D6 form a negative full-wave rectifier. The diodes in the power supply can be any silicon rectifier—the 1N4001 is an economical choice. The capacitors are all 470 µF 35 WVDC, Radio Shack #272-1018. Filter capacitors C4 and C5 reduce the +15 V and -15 V ripple to about 1 V_{pp} when the load current is 50 mA and less for lighter loads. The ripple is further reduced by the de-ripplers Q1 and Q2. The capacitors C6 and C7 at the bases of Q1 and Q2 are charged by D7 and D8 and discharged by the base currents of Q1 and Q2. The voltage at the emitters is approximately 0.6 V below the voltage at the bases. The h_{FE} of Q1 and Q2, Darlington transistors, is greater than 10,000, so the base current is only 5 µA when the collector current is 50 mA. With perfect capacitors, the ripple voltage would be 88 μV_{p-p}. It is safe to say that the ripple voltage is less than 1 mV.

Voltage for the 1 kHz test oscillator U1 in **Fig. 1** is provided by the voltage regulator U3 in **Fig. 3** or **Fig. 4**. The absolute voltage is not critical, but it must be well regulated. The 78L08AC has a tolerance of 5%. Therefore, the test signal amplitude can be in error by 5%. For the greatest accuracy, U3 can be made a 78L05C, a 5 V ± 10% regulator and the output adjusted to exactly 8 V with the variation shown in **Fig. 4**. The voltage across R21 is a nominal 5 V, the output of the regulator. R22 is adjusted so that the voltage across R21 and R22 is exactly 8 V. The current in R21 is nominally 10 mA and the current in R22 is 10 mA plus the bias current of U3. The bias current can be as high as 1.5 mA so that a 500Ω variable R22 can have a voltage drop variable from 0 V to 5.75 V. The output of the supply can be varied from 5 V to 10.75 V.

A less complex test fixture shown in **Fig. 5** measures I_{DSS} and V_{gs}. The values of I_D, V_{off}, and g_{fs} can be calculated with these measured values. A calculator that computes squares and square roots makes the calculations easy. With the proper polarity voltage applied to the drain with S1, the drain current I_{DSS} can be measured by shorting the gate resistor R1 to the source with

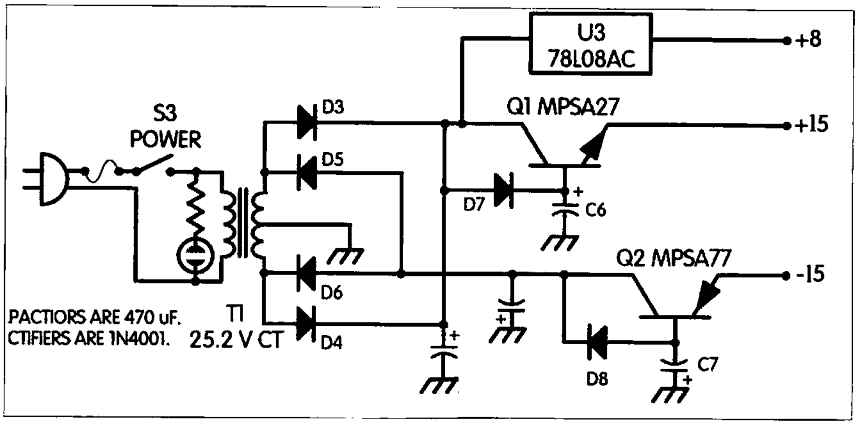


Fig. 3. The power supply has low ripple. Note: All capacitors are 470 µF; all rectifiers are 1N4001.

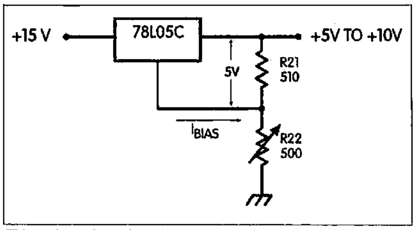


***Fig. 4.** A fixed voltage regulator can produce an adjustable output.*

S2. The gate current is a few picoamps when the gate is reverse-biased, so the voltage drop across RI can be ignored. V_{gs} can be measured by connecting R1 to ground with S2. V_{gs} is the voltage across Rs. I_D is V_{gs}/Rs. Accurate calculation of I_D requires that Rs be precisely known. With these measured and calculated values of I_{DSS}, I_D, and V_{gs}, the other parameters of the DUT can be calculated.

The basic interrelationships of JFET parameters are given by Evans in *Designing with Field-effect Transistors:*

$$I_D = I_{DSS}(1 - V_{gs}/V_{off})^n$$
(Equation 1)

Evans states: "Some texts indicate a value of 3/2 for n; however, experimental measurements on a number of N-channel geometries indicate the exponent n is close to 2."

Taking n as 2, **Equation 1** can be rearranged to solve for V_{gs} and V_{off}:

$$V_{gs}/V_{off} = 1 - \sqrt{(I_D/I_{DSS})}$$
(Equation 2)

$$V_{gs} = V_{off}[1 - \sqrt{(I_D/I_{DSS})}]$$
(Equation 3)

$$V_{off} = V_{gs}/[1 - \sqrt{(I_D/I_{DSS})}]$$
(Equation 4)

$$g_{fs} = 2I_D/(V_{gs} - V_{off}) = 2\sqrt{(I_D I_{DSS})}/V_{off}$$
(Equation 5)

where

I_D = drain current for the particular value of V_{gs}

V_{gs} = gate-to-source voltage

I_{DSS} = the drain current when V_{gs} is zero

V_{off} = gate voltage required to reduce I_D to zero

g_{fs} = the forward transconductance; the change in I_D for a change in V_{gs}, $\Delta I_D/\Delta V_{gs}$

Given I_D, I_{DSS}, and V_{gs}, V_{off} can be calculated with **Equation 4**. With V_{off} known, g_{fs} can be calculated with **Equation 5**.

The power supply for the simplified tester can be any source of 12 V or so that can supply the necessary I_{DSS}. S1 can be used to switch the polarity for N-channel and P-channel transistors, or the supply can be reversed manually. S2 connects the gate to the source when I_{DSS} is measured or to ground when V_{gs} is measured. R1 in the gate of the DUT limits the gate current if the gate is forward-biased. The value of R1 can be anything from 10 kΩ to 100 MΩ. Rs can be any value from 10 kΩ to 20 kΩ, but it must be precisely

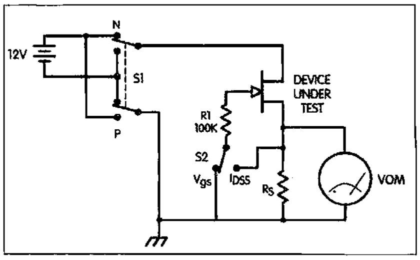


***Fig. 5.** A simplified tester provides essential information.*

known. The resistance of the voltmeter shunts Rs when V_{gs} is being measured. Therefore, when calculating I_{DSS}, the parallel combination of the voltmeter resistance and Rs should be used. However, if the voltmeter is 2 MΩ or greater, its resistance can be ignored. While an analog VTVM is satisfactory, the readability and resolution of a digital multimeter is very desirable. The shunting effect of Rs while measuring I_{DSS} must also be recognized. When Rs is 10 k and the meter resistance is 30 Ω (typical for a 1 mA movement), the meter will read 0.03% low and can be ignored.

With g_{fs} determined, a low-frequency amplifier can be designed or the operating point of a VHF amplifier can be established. The value of g_{fs} is valid for frequencies at which lumped constants are appropriate. Above 100 MHz, S-parameters are more appropriate for the RF concerns, but the bias needed can be obtained with the parameters found with the tester.

When a number of transistors are to be evaluated, the tester shown in **Figs. 1 through 3** can eliminate calculations and save time. While the calculations required with the simple tester are not tortuous, they can be a bother if several devices must be evaluated.

The tester is a convenient thing to have around if you do much home-brewing. When it comes time to troubleshoot (test) your design, you don't know if you're testing the construction, the design, the components, or the test equipment. If the component's parameters are only vaguely known, you're starting in a deep hole. A tester of some sort is a great help in filling that hole.

All-Copper 17 Meter X-Beam

A nearby hardware store, a free afternoon ...

Ed VanOverloop WA2UGT
106 North 5th Street
Park Ridge NJ 07656

I recently decided that I would like to have a beam for my current favorite HF band, 17 meters, so I reviewed my collection of antenna articles and books on the subject for an easy-to-build design. After checking out my usual local sources of antenna construction materials, I discovered that building even a simple aluminum yagi would present both mechanical and supply problems. On the other hand, I found that I could easily put together an all-copper X-beam from locally available materials.

Our nearby Home Depot™ building supply store had everything I needed! Even using all new materials, the cost would be just over $30. I estimated that the antenna could be on the air in less than four hours from the start of construction.

The main beam elements are standard ten-foot lengths of half-inch residential-grade copper water pipe, with 14-gauge stranded copper wire added to the element ends to achieve resonance. The copper water pipe is supported by a simple pine and plywood base in the shape of an "X". This yields a surprisingly light total weight of just over eight pounds. **Table 1** contains a parts list, **Fig. 1** shows a side view of some of the construction details, and **Fig. 2** is a bird's-eye view of the antenna.

Construction is quite straightforward and should be no problem for anyone who is even a little bit handy. The pine and plywood pieces are cut to size, sanded, and given a coat of orange shellac as a wood sealer. The base and crosspieces are then assembled, using wood screws, and the entire assembly is given two coats of a good outdoor enamel paint. The two 10-foot copper pipes used as a director are connected with a 90° copper elbow and soldered using a propane torch.

Once the wood base and the copper director assembly are ready, the copper elements are mounted on the wooden base by using one-quarter-inch plastic tie wraps passed around the copper pipes and through four 5/16-inch holes drilled in each of the one-inch by three-inch support arms. (I used short pieces of the cut-off plastic tie wraps to insulate the copper pipes from the wooden support pieces.) Be sure to space the two radiator feedpoint ends

17 Meter X-Beam Parts List

Qty.	Description
2	1" x 3" x 5' pine boards
1	12" x 12" x 1/2" exterior plywood
1	30" x 30" x 1/2" plywood brace (see **Fig.** 1)
1	1-1/4" pipe flange
4	1/4" x 1-1/2" bolts, washers, and nuts
1	1-1/4" EMT connector
1	1-1/4" EMT thin-wall electrical conduit 18" long
1	1/2" copper elbow
4	1/2" x 10' copper water pipe
24	1/4" wire tie wraps
26'	#14 gauge stranded copper wire

***Table 1.** Parts list.*

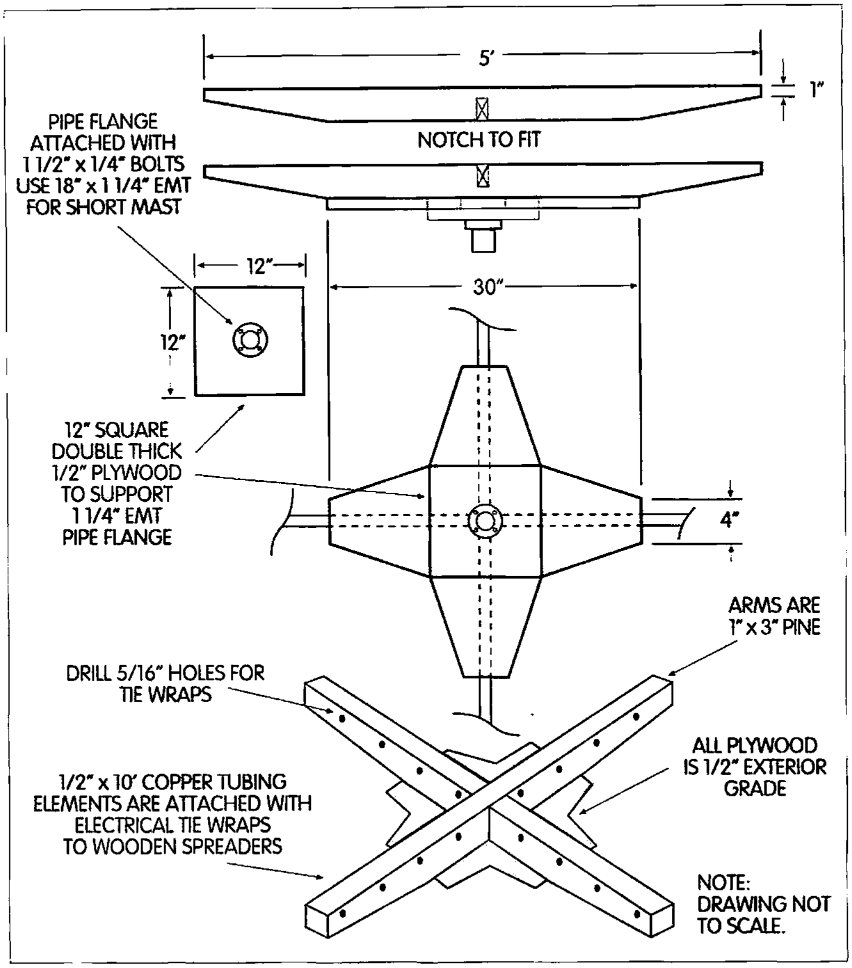


***Fig. 1.** X-beam pictorial.*

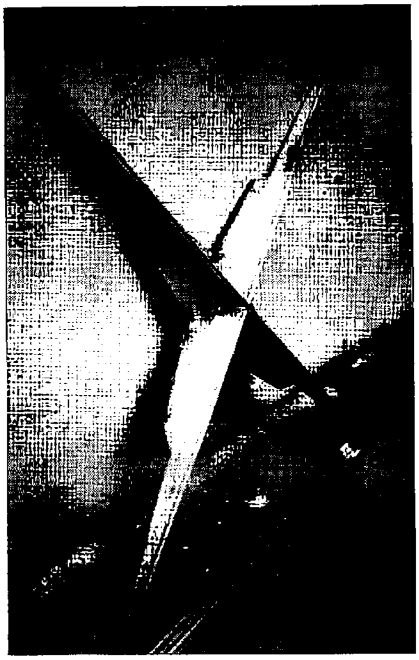


***Photo A.** Shellacked and ready for assembly.*

about one inch apart and at least one quarter inch from the director assembly.

The copper-wire pigtails are then soldered to the ends of the copper pipe (as indicated) and the wires are connected together with 30- to 50-pound-test fishing line. The other ends of the copper pipes are also joined together with fishing line and tie wraps passed through small holes drilled in the element ends. All copper elements are then coated with a clear spray finish to reduce corrosion.

The completed antenna is now ready to be mounted on your favorite rotator, and connected to your rig using 50-ohm coax feedline. It does not matter which radiator receives the center conductor of the coax and which receives the shield. The coax should have an eight-turn, six-inch diameter, RF choke coil wound right at the feedpoint connection to act as a balun and keep all of the RF energy at the antenna. Finally, be sure to seal the end of the coax to protect it from the weather.

Once the installation is complete, go down to your shack, turn on your rig, and see how well your new X-beam works! The first thing I did was measure the SWR. I found it to be flat at 1.4:1 from band-edge to band-edge. I plan to install a simple hairpin match across the feedpoint to bring the SWR down to 1:1; but then again, I'm a purist. You may decide that an SWR of 1.4:1 is fine.

At this point, I decided to get on the air and make some contacts. The first contact was deep into Russia, and I received a 5-8 report. Shortly thereafter, I received a 5-9 from Istanbul, Turkey, after busting a pileup. Pleased with the initial performance, I spent the next several weeks comparing the X-beam to my old standard antenna, a full-wave 80-meter horizontal loop.

I have already worked six-band DXCC (with over 140 countries on 17 meters alone, using this loop antenna and a 100-watt rig), so I feel that the 80-meter horizontal loop is a more than adequate performer to use as a comparison antenna for my new beam. It came as a pleasant surprise to find that the X-beam was between one and four S-units better than the large multiband wire antenna on 17 meters.

The X-beam has a two to three S-unit front-to-back ratio, and a three to four S-unit front-to-side ratio. My friend Chris WB2VVV modeled the X-beam using an antenna-analysis computer program, and found that the "X" is actually better than a conventional two-element yagi in every performance category!

Why this easy-to-construct and highly effective lightweight antenna has been mostly ignored is a mystery to me; but if you have an urge to build something, you will find this antenna hard to beat on a dollars-per-dB basis. The design may be adapted to any band between 10 and 20 meters using the measurements in the chart shown at **Table 2.**

For the mathematically inclined, I have included some formulas which I found to be helpful in designing the X-beam (see **Table 3**). Of course, depending on the materials used, the

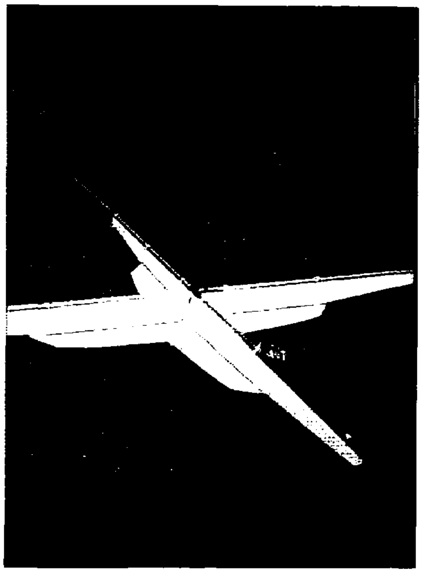


Photo B. Painted and ready for mounting.

Approximate Phone Band Dimensions			
Frequency (MHz)	Element Lengths	Pigtail Lengths	
		Radiator	Director
28.500	6' 10.0"	3' 9.0"	3' 3.0"
24.950	7' 9.5"	4' 4.0"	3' 9.5"
21.300	9' 2.0"	5' 0.0"	4' 4.0"
18.140	10' 0.0"	6' 6.0"	5' 10.0"
14.275	13' 8.0"	7' 5.5"	6' 5.5"

Table 2. Approximate phone band dimensions.

Photo C. Flying high at 40 feet.

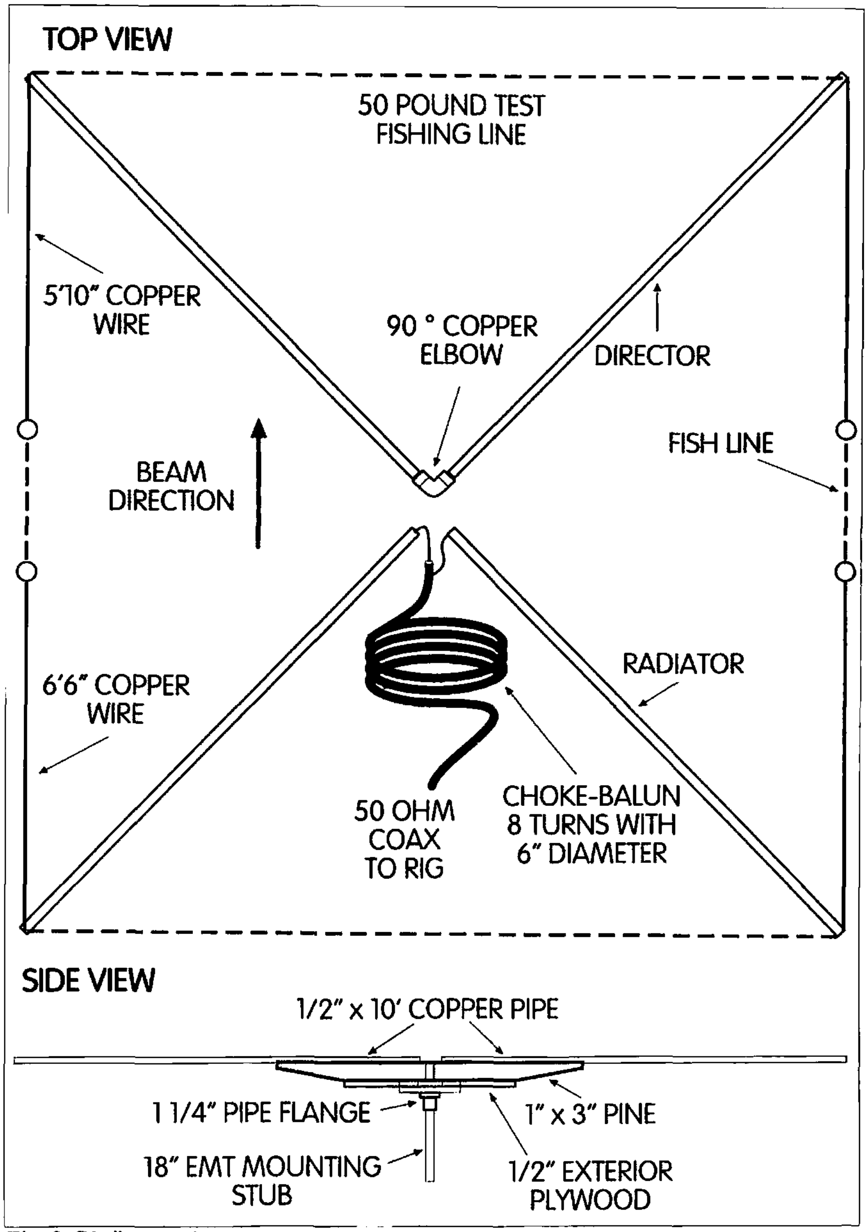


Fig. 2. Bird's-eye view.

actual dimensions of the antenna needed to obtain resonance may be slightly different than the calculated lengths. The dimensions of my 17-meter beam do not agree with the lengths calculated by using the formulas because I wanted to use ten-foot arms for the radiator and director elements. Do not use full quarter-wavelength elements for the radiators or director, as the favorable beam characteristics will downgrade.

Note: While the physical design of this antenna is all mine, the formulas and idea for building one of this type came from an article by Brice Anderson W9PNE in the 1985 *ARRL Antenna Compendium.* My thanks to Brice ...

X-Beam Formulas	
Radiator Arm Length (feet)	195 / f (mHz)
Radiator Pigtail (feet)	106.5 / f (mHz)
Director Arm Length (feet)	195 / f (mHz)
Director Pigtail (feet)	92.5 / f (mHz)

Table 3. X-beam formulas, from information by Brice Anderson W9PNE.

Preparing for the Big One

Don't get caught short in a disaster!

Peter L. Barker XF1/KB6ASH
La Jolla de Los Cabos AB-506
San Jose del Cabo
B.C.S. 23400 Mexico

Anyone who has been watching the TV news over the past months must have become acutely aware of the devastation that is caused on a seemingly regular basis by Mother Nature, industrial accidents and now even terrorists. Whenever one is asked to justify the allocation of ham radio frequencies to our use, the words "emergency communication" leap to the lips, but how many of us are really prepared to operate our equipment effectively in an emergency?

When the emergency strikes, it's too late to try to throw together an emergency operation; however, a little preparation can make all the difference between helplessly licking one's wounds and providing a valuable service to your community and emergency services.

This article is not aimed at members of organized emergency response teams such as RACES and ARES, although the ideas apply equally well to them, but at the ham who has the basic equipment and may just need to organize some simple items to enable them to function in a disaster situation.

Before we get into the technical equipment, let's look at a basic support package that can make the difference between being effective and being just operational. You probably have much of this information and material somewhere around the house, so why not collect it together before you need it?

• A list of emergency service phone numbers for your area.

• Frequencies of any existing emergency nets, including those you *can't* work with the equipment you presently own.

• City, county and state maps (waterproof ones if available); copies of any special grid maps issued by local emergency services.

• Supply of pens, markers, paper clips and note paper. Steno pads are easy to use, and you can attach a pen to them with a short length of string.

• Good-quality flashlight, spare batteries and bulb (Maglite™ type).

• Small battery-powered clock with backlighted face. A digital alarm or something similar that you can set to UTC and 24-hour format is best, as many emergency nets operate using UTC time.

• Copies of personal ID and ham license.

• Repeater directory or list of all state repeaters and PL tones.

• Bottled water and snack items, like individually-packaged granola bars, that will keep well.

The items should be stored together ready for use in a sturdy container marked as emergency equipment and with the owner's name and callsign. Strong plastic tool boxes are widely available in many sizes often in various bright colors. These boxes, while not waterproof, do provide compartments and are fairly weather- and dust-resistant. It is a good idea to seal the kit with a cable tie so that you can see if someone has disturbed it and "borrowed" something! Pick bright colors as they are easier to find in a confused area or situation. It is also a good idea to attach some reflective tape to the box; it really stands out when swept by

a flashlight. If cost is no object, very strong watertight cases are available, but be prepared to pay almost as much for the case as for the contents!

What equipment is best for emergency use? For equipment to be of any use it must operate independently of mains electricity and on widely-used frequencies. Your microwave gear or six meter equipment will not be of much use. Most importantly, it should be reliable equipment with which you are *thoroughly* familiar. If you are fumbling around trying to figure out how to enter a PL or adjust the radio you will be more of a liability than a help.

Probably the most useful radios are a rugged two-meter handheld and a compact HF rig that operates on 12 VDC. It is a bonus if these radios will receive outside the ham bands, so that broadcasts from various aid agencies can be monitored.

A word of caution: Most radios that receive outside the ham bands can be modified to transmit on other frequencies, too. Unless you are specifically authorized to use other than ham frequencies, you do so at your own risk. Even in an emergency you may be subject to legal sanctions for transmitting on other than ham frequencies. If you are the party in a life-threatening situation, however, it probably wouldn't result in any action by the FCC.

Powering the equipment

Unless you are working on this project as a group, you will probably not be investing in a gas-powered generator to run your equipment, so we will examine the battery-power option.

For a VHF rig, there are several options. Rechargeable batteries that fit directly on the radio are fine for short-term use, especially if you are in the listening mode most of the time. However, even if a couple of fully-charged spares are on hand, the transmit time is very limited. Recharging the battery packs can also be a problem if the emergency extends over several days or is in a remote location. Solar chargers can be constructed, but to deliver a rapid charge, the panel size and cost are significant and, of course, they require pretty much direct sunlight to deliver a useful output.

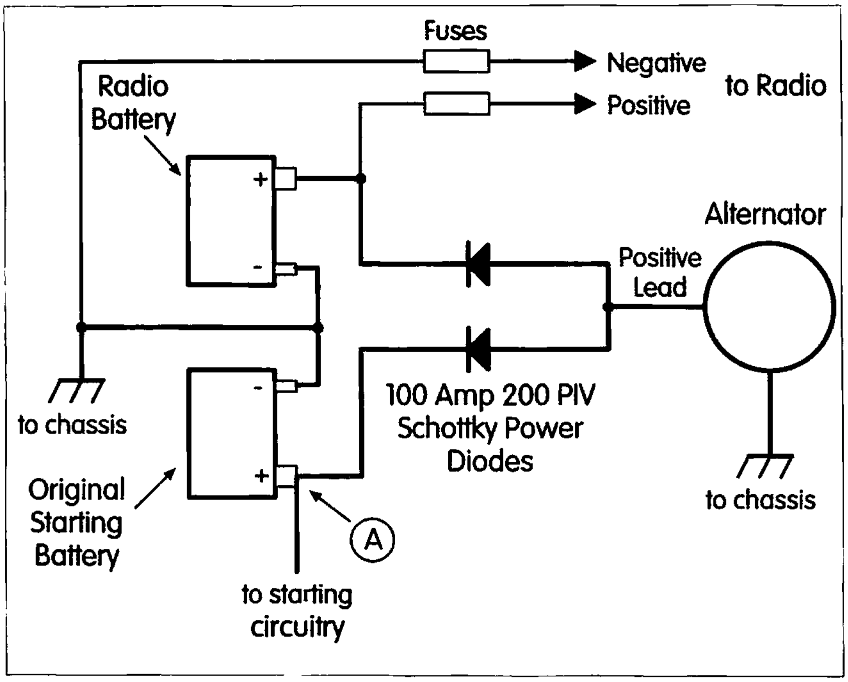


Fig. 1. Dual battery system. If the alternator has a "sense" lead, connect it to point A. If there is no sense lead, check the charge regulator to see if you can adjust it to deliver about 0.3 volts more to compensate for the voltage drop across the diode. If there is no sense lead or adjustment, the batteries may not develop a full charge.

The easiest alternative is to use the manufacturer's pack for alkaline cells or make an outboard battery pack that takes "C" or "D" cells. These outboard packs can be fashioned to clip onto a belt, and if "D" cells are used, will deliver 15-20 times the life of an "AA"-cell-filled pack. Alkaline batteries have a long shelf life and now even come with built-in testers.

For a semi-fixed location, a good supply can be provided by a 12-volt gel cell. They are readily available on the surplus market and if carefully selected can provide excellent service. They are available in many sizes. The six to eight amp-hour version will provide many hours of continuous use for an HT even on high power. It may be stating the obvious, but be sure that your HT can safely operate on 12 volts. If not, you will need to make an adapter (suitable circuits using a few easily found components can be found in the *ARRL Handbook* as well as many other ham radio sources).

Powering an HF rig is more of a challenge. It is reasonable to assume that you will not be carrying the rig around while operating but even this is possible with some of the sub-compact models now available.

The almost universal source of emergency power for HF rigs is the 12 V storage battery. In descending order of desirability and cost they are:

1) Gelled electrolyte, marine storage;

2) Standard electrolyte, deep cycle;

3) Automotive starting battery.

Option 1 is significantly more expensive than the other two but has several special characteristics that make it worth considering: It can be stored in a discharged condition for extended periods without damage; it can be recharged at a very high rate (but requires a special charge controller); it cannot be spilled and can even operate under water (just insulate the terminals); and it does not emit any explosive gases when charging. A typical 95 Ah battery will cost in the region of $220.

Option 2 is the most popular and easily available. They are designed to be repeatedly discharged to the 50% point with no damage if recharged shortly afterwards. They are available in many sizes; the most common is the 105 Ah unit available everywhere in the $55 to $70 price range.

The third option should only be considered if no other is available. The automobile starting battery is designed to deliver a very heavy current for several seconds and then be immediately fully charged. It does not survive many deep discharges. If you're planning to use a battery installed in a vehicle for an emergency supply, do not run into the common trap of running it so low that you cannot start the motor to move or recharge the battery. A separate radio battery is strongly advised. Using a couple of power diodes on a good-sized heat sink will allow both batteries to be charged simultaneously, while delivering the majority of the charge to the battery most in need. This hookup (**Fig. 1**) allows the radio to draw only from its own battery, leaving the starting battery charged for its intended purpose. Similar units are available from automotive and RV parts suppliers.

The amount of operating time that can be expected from a fully charged battery is quite variable depending on transmission mode, transmit to receive ratio and to some extent ambient temperature. Many modern rigs seem rather touchy about the lowest voltage at which they will reliably operate. Although they are nominally rated for 12 V, their specifications are given

Band	Inductance	Number of Turns	Turns to Occupy	Antenna Length A
80 m	40 µH	35	3.5"	15' 6"
40 m	25 µH	21	2.1"	8' 1/2"
20 m	8.8 µH	14.5	1.5"	4' 2"

***Table 1.** Different bands require different turns.*

for operation on a voltage of 13.8 V, the voltage of a fully charged battery on a float charge. If you are considering a new rig for emergency use, check the minimum operating voltage. The ideal would be one that would operate reliably down to 11.5 V.

The "standard" 100 W rig consumes between one and two amps on receive, and around 20 amps on voice peaks in SSB. The average current used on transmit is, however, much lower. If we consider a 4:1 listen/talk ratio, a figure of 6 Ah per hour of operation would be a usable ball park figure. This would allow at least 10 hours continuous operation from a fully-charged 105 Ah battery before recharging becomes necessary. Unless you are a net control station, you may find you talk much less than 15 minutes per hour, and can also reduce your output power to conserve your battery.

If you are going to be working as a group on an emergency plan, it is a very good idea to consider agreeing upon a standard connector for all power leads. The cigar lighter connector has been pressed into service for everything from cellular phones to spotlights; but a much better alternative is a Molex™-type connector. These are widely available in an extensive range of ampacity and pin configurations. Whatever you decide upon, be sure it is polarized. When in a hurry, or poor light, even the most careful operators have hooked up a red wire to a black terminal.

Skywires and spikes

When operating under less than ideal circumstances and with limited power, a reliable and effective antenna is an essential piece of gear. You shouldn't rely on moving existing antennas or throwing something into the car at the last minute.

For VHF emergency work using repeaters, the usual vehicle-mounted antenna or a good radio-mounted antenna will normally suffice. But much emergency traffic is handled simplex to liberate the repeater, if it is still operational, for longer-haul traffic or information broadcasts. For simplex work, an antenna that can be given some physical height is worth much more than a more powerful radio. A simple, effective antenna that works very well in this situation is a flexible J-pole made from twinlead and fed with 50 ohm coax. It can be rolled up and stored easily in the emergency kit, and you can suspend it in the clear from trees and structures using thin twine or monofilament. This antenna does not need a ground plane to radiate well and shows a lot of gain over the lossy rubber ducky.

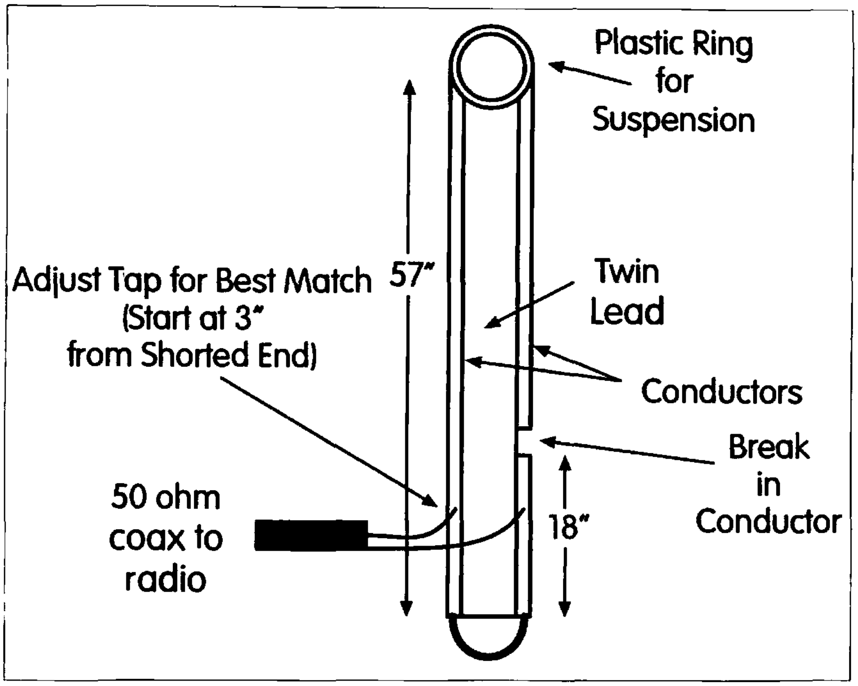


Fig. 2. Twinlead "J" antenna. Antenna shown is for 2 m. It is quite broadbanded. It can be scaled for 220 MHz or 440 MHz.

The "J" type of antenna (**Fig. 2**) has appeared in many construction articles in *73* and other publications, and is available commercially from several advertisers in the magazine.

An antenna for HF use is not so simple. Most mobile-type antennas look attractive for emergency use; however, almost every model requires a good ground against which to operate. If you only need to operate from a vehicle, this is satisfied by the capacitive coupling of the vehicle body to the ground; but if the antenna is removed from the vehicle, a substitute for this must be found. In a building, a long balcony railing or even handrail may serve if it allows the antenna to be mounted so as to be clear of walls, wires or metal structures. It is also possible to operate a mobile antenna against three or four raised ground radials cut to the operating frequency, but this is cumbersome at best and a poor system for rapid deployment. If you have two of the loaded whip mobile antennas, you can fashion a center bracket (**Fig. 3**) and operate the pair as a dipole. This will also work with the units with multiple loading coils and whips. Even if they are not quite identical or of the same make, it will generally function better than a single mobile antenna and a makeshift ground system.

As most HF emergency communication is over medium or even short range and on the lower frequencies (see my article, "Shooting Straight Up" in December 1996's *73 Amateur Radio Today*), height is not as important as it is for working DX. A robust simple dipole fed with coax, or a doublet fed with twinlead and a tuner, is the most versatile. It can be slung between two trees or buildings, hoisted on one support in the middle, stretched out from a building or post as a sloper and even bent around to fit an irregular space. These antennas are described in almost every ham manual and can be constructed by even the most "appliance operator" sort of ham.

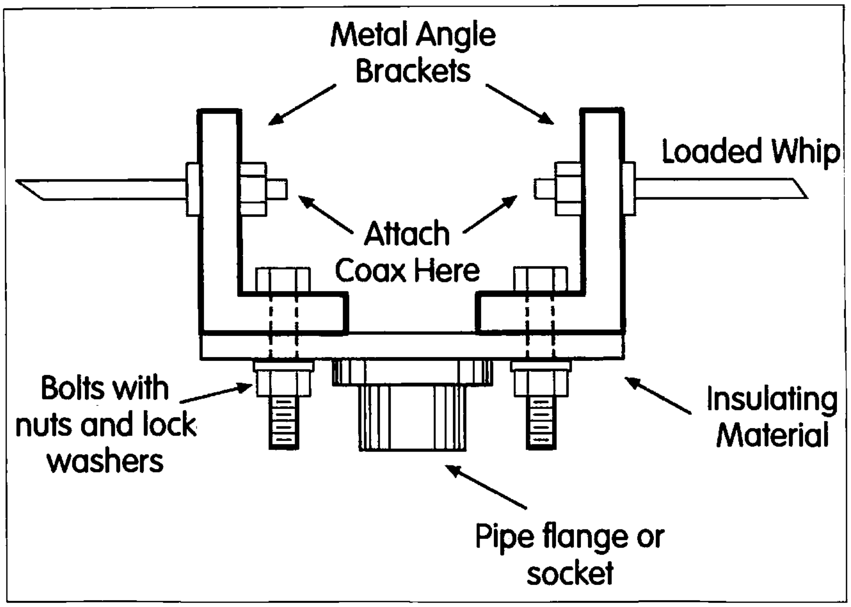


Fig. 3. Dipole mounting bracket for mobile whips. Be sure that the flange does not short the two brackets together!

Size can be a problem with a resonant dipole on 80 and 40 meters so an inductively shortened dipole may be something you want to consider for this kit. A dipole can be shortened to one half the usual length if coils—not traps—are inserted at the correct point. The coils should have a reactance of about 950 Ω at the operating frequency and be installed 1/16th wavelength from the feedpoint in each leg of the dipole. A further 1/16th wavelength of wire completes each leg (**Fig. 4**).

Commercial versions of both regular and shortened dipoles are also available from advertisers in this publication.

Whatever you choose as an HF antenna, some simple practical concerns arise. Store the antenna in a manner that allows it to be deployed without having to spend hours untangling the beast. Winding the sections on empty plastic two-liter soda bottles is a simple solution. The whole antenna and feedline should be stored in its own container. A five-gallon paint bucket or plastic cargo box is a good choice. Include with the antenna a good length of light cord or heavy monofilament to attach the radiator to its supports. A slingshot and a few fishing sinkers allow the support line to be fired over many prospective supports.

As always, when raising emergency antennas, be aware of power lines and machinery. Never use power line structures as antenna supports. Even power lines that appear to be "dead" may still carry sufficient voltage to be lethal and may re-energize without warning. Machinery may also restart suddenly when power returns. Don't add to the emergency by becoming part of it!

Whatever type of antenna setup you plan, it is likely to be less than optimum when strung up for use. It is a very good idea to pack, with your radios, a small mobile-type tuner with built-in SWR meter. The tuner, of course, does not make the antenna any better, but will match the impedance of the antenna to the radio. Modern solid state rigs have protection circuitry that backs off the RF power if it detects even a small mismatch. The tuner will satisfy the radio's need to "see" a 50 Ω impedance. If you plan to use a doublet fed by twinlead on several frequencies, a tuner will be essential.

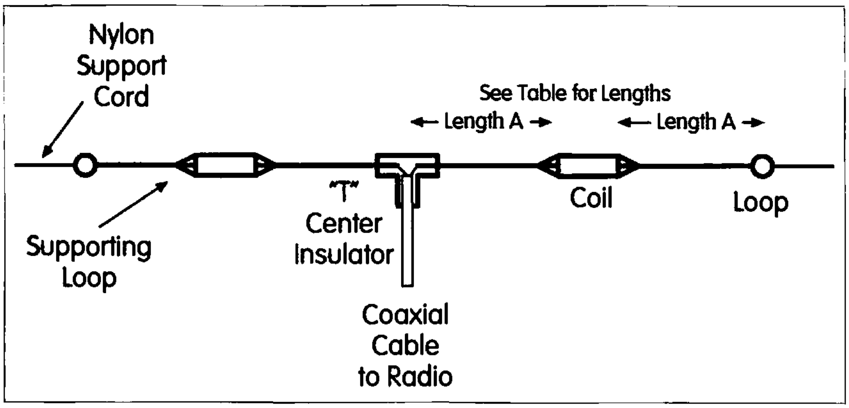


Fig. 4. Shortened emergency dipole (not to scale). The coil can be wound on PVC or other insulation former using 16-gauge magnet wire. The form should have an outside diameter of 2-1/2 inches. Spread turns evenly. The shortened antenna has a narrower bandwidth than a standard dipole; a tuner will be needed for full band coverage.

Accessories and tools

No emergency preparedness package would be complete without a basic tool and spare parts kit. It is preferable that this is a dedicated selection of materials that is not raided for other purposes. The whole point of the package is that it is ready and complete for immediate use. The following list is not intended to be exhaustive but to get you thinking along the right lines.

- Special tools, if required, for any of your equipment
- Fuses for all fused leads
- Medium and small straight and cross point screwdrivers
- Set of jewelers' screwdrivers
- Needle nosed pliers
- Diagonal wire cutter
- 12-volt soldering iron, cored solder & strips of sandpaper
- Small clamping pliers
- Simple volt/ohm meter with probes
- Penlight, spare batteries & bulb

• Several feet each of red and black hookup wire of various gauges

• 50 feet or more of light antenna wire

• 50 feet of RG-58 coax with connectors & two barrel connectors

• Assortment of coax, power and crimp connectors. Even if you use fully-soldered coax connectors under normal conditions, consider using simpler crimp-style UHF connectors for this kit.

• Small tube of silicone sealant and assortment of PVC & duct tapes

• Combination wire stripper and crimp tool. You may also want to consider a small battery charger and extension cord in the event that power returns or someone has a generator running.

As a retired engineer and offshore sailor, I believe that it is impossible to have too many tools. The emergency tool kit cannot pretend to cover every eventuality and still remain compact and portable. The above collection will address most field-repairable problems and temporary installations and, apart from the wires, can be contained in a small plastic tool box or roll.

With all these specially assembled kits, it's a good idea to mark the tools distinctively—colored plastic dips are available. This helps to locate and retrieve them in the clean-up phase of the emergency. You should also put an inventory check list inside the lid of the container.

A final, more subtle, preparation is to spend a little time listening or participating in controlled nets, and listening to professional communicators handling emergencies. The communications procedures and disciplines you will learn are exactly those that will enable you to be an asset if called upon to work emergency traffic. Learn to communicate facts only, not rumors, and if you have nothing important to add to the traffic, remain silent.

If you think that all this preparation for something that may never happen is a lot of work for nothing, you may be right.

And if you *are* right, you should be thankful!

Saluting the Flag

Another twist to the delta loop.

Doug Person W4DXV
10306 Yandem Court
Charlotte NC 28269
[ki6bq@amsat.org]

Over my 36 years in ham radio, I have found building and experimenting with various antennas to be both my primary area of interest and a source of great satisfaction. Antennas remain an area of experimentation that is still accessible to the average amateur. With a few trees, some wire, a few insulators, and a length of coax, you can build a number of different and interesting antennas.

After building and evaluating a number of dipoles, longwires, windoms, and verticals, I've come to have a favorite antenna: the full-wave loop. And here is yet another variation of that venerable wire antenna for you to try: the flag delta loop. This antenna and its method of construction will work equally well on all HF bands and six meters.

While full-wave loops are certainly not new, they are about as easy to construct as a dipole and offer a few advantages over the more common half-wave wire antenna. Full-wave loops exhibit a small amount of gain (about 2 dB) over a dipole, tend to have a lower angle of radiation, and appear to be less sensitive to being operated closer to the ground. I'll refrain from making any comparisons more scientific than these. I would prefer that you build this antenna, compare it to what you are using now and see for yourself how well it performs.

The "flag" configuration solves many of the problems I face at my QTH, and perhaps ones you face at yours as well. Let me explain. I live in what has become the classic modern suburban subdivision—where CC&Rs (covenants, conditions, and restrictions) prohibit most types of radio antennas. At least they prohibit *conspicuous* antennas. When made of thin wire with black components and hidden among the trees, wire antennas go largely unnoticed. And what isn't noticed is certainly in keeping with the spirit of most CC&Rs, which exist to maintain the neighborhood's beauty. (Actually, they exist to maintain the subdivision's sales appeal, since the developer probably is responsible for enacting the CC&R. But that's another issue and I'll refrain from stepping up on my soapbox right now.)

My lot has a number of trees along the back of the property line. Within them and between them is my antenna farm. When you are trying to erect an inconspicuous wire antenna in a tree, it is better to keep as much of the wire and coax as you can near the trees to hide it among the leaves and shadows. If an antenna and feedline are hanging out in plain sight in the middle of your backyard, it might attract the very unwelcome attention of your nosy neighborhood association's architectural committee.

The flag delta loop is suspended from a tree the same way a triangular flag might be suspended from a flagpole. The feedpoint is at the bottom angle. By doing this, the feedline, matching section and most of the antenna's weight is supported by the vertical support rope. The feedline is also kept close to the supporting tree and thus remains far less conspicuous. A second horizontal support line is used to pull the triangle open. Since there is practically no weight on the horizontal support line, you can use something as light as fishing line for increased stealthiness.

Putting the flag delta loop together is very easy. It's certainly no more difficult than the average dipole and, owing to its very broadband nature, it's far more forgiving of dimensional errors. All that is required to build a flag delta

loop is three insulators, an SO-239 or similar connector, enough wire for the band of your choice, and a small length of RG-59/u for a matching section.

I use the small, glass-filled, dark gray Hy-Que™ insulators that usually cost less than a dollar each. I buy a handful of them at every hamfest I go to. The wire I use is 18-gauge solid copper stranded. I found a 500-foot spool in the electrical department at the local home improvement center for 11 dollars. That's far less than three cents a foot, and a real bargain. They usually sell it by the foot for wiring ground connections in lamps and appliances. The extra thinness of 18-gauge adds to the stealthiness of my antennas and means my line is considerably lighter than the typical 14-gauge wire more commonly used. I have had no trouble pumping a kilowatt of single sideband RF into it and it certainly seems strong enough for all of the wire antennas I've built. Any wire, however, will work just fine—as long as it is strong enough to form the vertical side of the triangle and support the matching section and coax.

Now let's build a flag delta loop antenna. You can make one for any band you like using these same calculations and construction techniques. I will describe for you the building of a 20-meter flag delta loop.

To begin, we need to determine a few dimensions. To calculate the amount of wire needed to form the loop, I have found that the formula

loop length = 1023/operating frequency

consistently results in loops that resonate right where I want them to. I realize that most books will indicate a constant of 1005, which is the value I originally used. My experience with this number was that the loops were consistently too small. After five or so successful antennas, it was clear that 1023 is much closer to the desired loop size.

A 20-meter loop would then be calculated as:

$1023/14.175 = 72.17$

The total amount of wire needed for a 20-meter loop would be 72 feet and two inches. You divide this value by three to get the three equal sides of the triangle, resulting in 24 feet 2/3 inches per side. Because the antenna is so broadbanded, you can safely forget the extra two inches in total length, leaving you with a convenient 24 feet per side.

Full-wave loop antennas have characteristic impedance of about 100 ohms. This is actually quite usable, since it will result in an SWR of about 2:1. However, it is a simple matter to bring the 100 ohms down to a more acceptable 50 ohms by using a quarter-wave matching section of RG-59/u coax.

To calculate the total length of the matching section, we have to consider two factors. First, we must determine the size of an electrical quarter wavelength. And second, we must factor in the velocity factor of the coax used for the matching section. There are two types of RG-59/u coax generally available—solid dielectric and foam dielectric. The velocity factors of these two are 66% and 78% respectively. I will assume that you are using the more common foam dielectric coax (available from Radio Shack™) that I use and therefore our velocity factor constant is 78%.

What exactly is a velocity factor, you are wondering? The short answer is simply that RF energy travels more slowly in a solid medium such as coax than it does though space. The velocity factor expresses how much more slowly. Any explanation more involved than this would be physics, and I'd rather talk about antennas.

Applying our two factors, the formula for calculating the length of the 20-meter matching section is

matching section length = (246/operating frequency) x velocity factor

or

$(246/14.175) \times 0.78 = 13.53$ feet

Since the matching section, like the loop itself, is very broadbanded, we can safely consider that 13.53 is close enough to 13 and a half feet to call it 13 feet 6 inches.

Now let's build our antenna. Assuming that you have a coil of wire to start with, attach the free end to one of the insulators, leaving a few inches extra

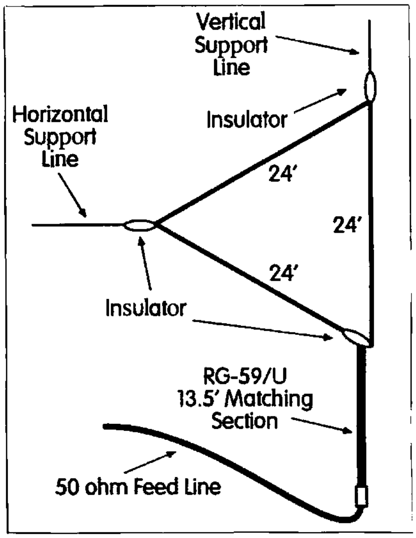


Fig. 1. Twenty-meter flag delta loop.

free for attaching the matching section. I can suggest two ways to secure the wire to the insulator. One method is courtesy of Mike Zuckerman WB2IVN, who likes to loop the wire back through the eye. When the loop is pulled tight, the wire is reasonably secure. The method I use is to pull the wire straight through the eye and then solder a small loop of wire above and below the insulator to lock it in place. If you plan to do this, it's easier if you slide the other two insulators onto the wire before attaching the bottom one.

From the bottom insulator, measure the first side of the triangle, unrolling the wire carefully. You want to avoid pulling the wire off the roll from the side because this will leave it in a state where it will have a strong desire to tangle and kink. Mark the end of the first side, 24 feet for 20 meters, with a piece of tape or a marking pen. It helps a lot to have someone assist you with the measuring. From the mark, measure the second side of the loop, marking the second apex in the same manner as the first one. Finally, measure the last side, mark it, give yourself a few additional inches, and cut the wire.

To use Mike's method of looping the wire through the insulators, slide the first insulator down the wire to the first mark. Loop the free end back through the eye of the insulator and pull all the wire through until the loop is tight. Repeat this process for the second insulator at the second mark. If you are going to use the wire loop method, then slide both insulators to each mark and solder the loops in place.

To create the matching section, I use an SO-239 for the junction to the 50 Ω feedline. I strip and solder one end of the RG-59/u to the connector and then measure the length, leaving an extra two inches for creating pigtails for soldering the matching section to the loop ends. You can get fancier by using a conventional center insulator such as the Hy-Que (the same brand and construction as the end insulators). If you choose to do this, then attach PL-259 connectors on both ends of the matching section and use a double female to connect the matching section to the feedline.

If you're wondering which side of the loop to attach the center conductor to, it really doesn't matter. I always connect it to the vertical side. Once you have the matching section complete and soldered to the loop ends at the insulator, be sure to seal it from the effects of the weather with coax seal or electrical tape.

After the flag delta loop is assembled, you'll need to get a line into the top of your tallest tree. My favorite method is a slingshot, a one-ounce fishing weight and a spool of 25-pound test fishing line. This method takes practice and is not for everyone. If you try it, keep in mind that sometimes the line breaks and that a one-ounce weight retains considerable energy and can cause serious damage to a person or property on the receiving end if not used with care.

I have a 20-meter dipole which favors the southeast and northwest. I put my new flag delta loop up favoring the northeast and southwest, hoping to improve my performance into Europe and Asia. After a few hours of operating with my new loop, I found the results to be beyond my best expectations. Signals from Europe were as much as three to four S-units stronger on the loop than on the dipole. Part of this is obviously due to the improved orientation. Nevertheless, some of it reflects the fine performance of the flag delta loop.

After a month of operating regularly with the flag delta loop, I am convinced that it is an excellent antenna. With my 800-watt amplifier on-line, I have cracked more pileups and worked more DX than at any other time in my ham career. I have since added a 17-meter version and will soon install a 15-meter loop as well. I hope you enjoy your flag delta loop as much as I have enjoyed mine.

Tear Apart Your Tube Supply

And get your glow on the go ...

Ronald Lumachi WB2CQM
73 Bay 26th Street
Brooklyn NY 11214-3905
[wb2cqm@juno.com]

If you want to gauge the spirit, loyalty, and enthusiasm of radio amateurs who operate vintage amateur radio equipment, dial in to the Drake Net on Saturday evenings at 8:00 p.m. EST at 3.865 kHz. You'll find that the participation is broad-based, the conversation invariably lively, the horsetrading almost frenetic, and the dedication to circa-1970 tube-type gear contagious—especially if you hang around the frequency long enough.

Many reasons can be cited for supporting this high level of commitment. For example, the most zealous participants point out that tube equipment, in spite of its age, continues to produce a level of audio quality clearly superior to the more modern gear. They vehemently argue their position that almost any radio amateur armed with a VOM and the operator's manual spec sheet can troubleshoot a problem and undertake an electrical fix without being overwhelmed by the complex integrated circuits and layers of tightly packed circuit boards.

They also acclaim the benefit of the higher output from the rugged final tubes that reduces the need for an amplifier in the vast majority of casual (non-DX pileup) on-the-air QSOs. They quickly add the fact that linear amplifiers operate more efficiently when driven with the higher output. They claim that dollar for dollar, pre-owned, high-performance, well-maintained equipment is easily within the affordable range of a larger number of operators—especially the newer hams—than is solid state gear.

They even note with a great sense of satisfaction (and ultimate vindication for their position) that tube gear was removed from military mothballs and placed on line as a result of the poor performance of solid state equipment in the harsh environment of Desert Storm. They go on and on in defense of the glow-in-the-dark rigs, but the arguments, in a nutshell, are based on the principle that you're getting more (and a better) bang for the buck.

A can capacitor catch-22!

When the inevitable parts replacement or rebuilding of a vintage piece of gear is necessary, tubes and other discrete capacitor and resistor components that cluster around the underside of the tube sockets are readily available from a variety of sources. Admittedly, catalog retailers often extract their pound of flesh for a dead special item they know to be in demand. They're responding to the first law of economics: The price of an item varies inversely with supply—so what else is new?

Amateurs are well aware that certain vacuum tubes, once commonplace, are now worth their weight in gold. If you combine the need for that component and the lack of discretionary time in today's lifestyle to ferret out reasonably priced replacements, the path of least resistance is: Bite the bullet and send the check for the part.

It may help to soothe the pain of the cash outlay to mentally amortize the price over the number of years it will be in use. Try it. It works almost all the time.

If you're not pressured, more affordable sources of supply may be explored. Consider a posting on the Internet or a packet bulletin board. Listen in or leave a listing on one of the many Horse Traders' nets. (See the June, 1997, issue of *73* for a complete schedule of these nets.) You can always plan a visit to a local hamfest to rummage around for your needs.

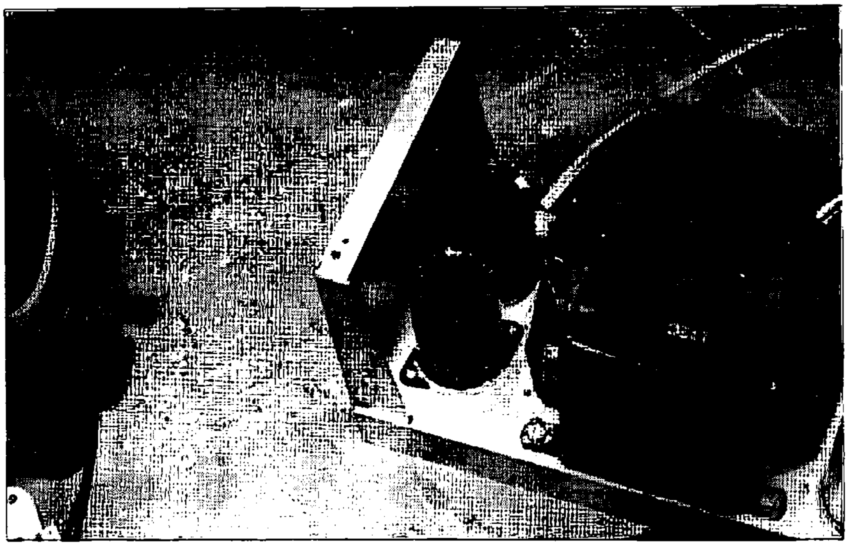


Photo A. A view of the replacement capacitors nestled comfortably on the Drake AC4 chassis. The caps were epoxied to the wafers and then reinstalled with the original mounting hardware. The capacitors' low profile makes them ideally suited to height-restricted power supplies. Note that the banded sides of the capacitors (indicated by the light colored block on the top) face in the same direction. This reduces the wiring runs when series installed by polarity (see text).

However, what you won't find in any of these sources, no matter how hard you look, is the typical power supply can-type capacitor with sufficient values and an accompanying high breakdown voltage rating. They simply aren't being manufactured on any great scale due to the proliferation of low-voltage, high-current solid state radio equipment being made to replace tube gear. Consequently, there's simply no demand for that value of component. If any New Old Stock (NOS) surfaces, view it with suspicion—capacitors tend to deteriorate over the years and their shelf life is limited. It's almost a catch-22 situation in which there is no practical solution to a real-life paradoxical dilemma: The older, the better, but the older, the better the chances it won't work, too. So what can you do?

We're in luck!

You will find that the garden variety glow-in-the-dark finals of a transmitter/transceiver require about 650–700 VDC for maximum output. Many manufacturers of vintage tube rigs utilized the voltage doubler circuit to obtain the correct level of power utilizing a transformer with sufficient current capacity but wound with only a moderate level of voltage output.

Size and cost constraints combined with good engineering practices resulted in the selection of this compromise method for achieving the necessary power requirements. The problem for the rebuilders today is that the two series-connected capacitors required for a typical circuit (see **Fig. 1**), each with a 350–450 VDC breakdown rating, haven't been available inexpensively from new stock for some time. When they do show up in the listings of various retail sources, they are never priced at less than $16–$18 per unit. Until recently, buying them at that price was a bummer—especially if a bunch of them were needed.

Because of the sticker shock, I'm convinced that many amateurs reluctantly retired their defunct equipment and relegated it to a dark corner under the bench. But things are looking up! It may have escaped your notice, but a retail parts catalog supplier began offering recent-manufacture, low-profile, high-capacity capacitors at $4.50 each (see end of article) that are perfectly suited for a rebuilding project. The good news is that they exceed OEM values and their short three-inch height allows mounting even in the lowest-profile power supply chassis.

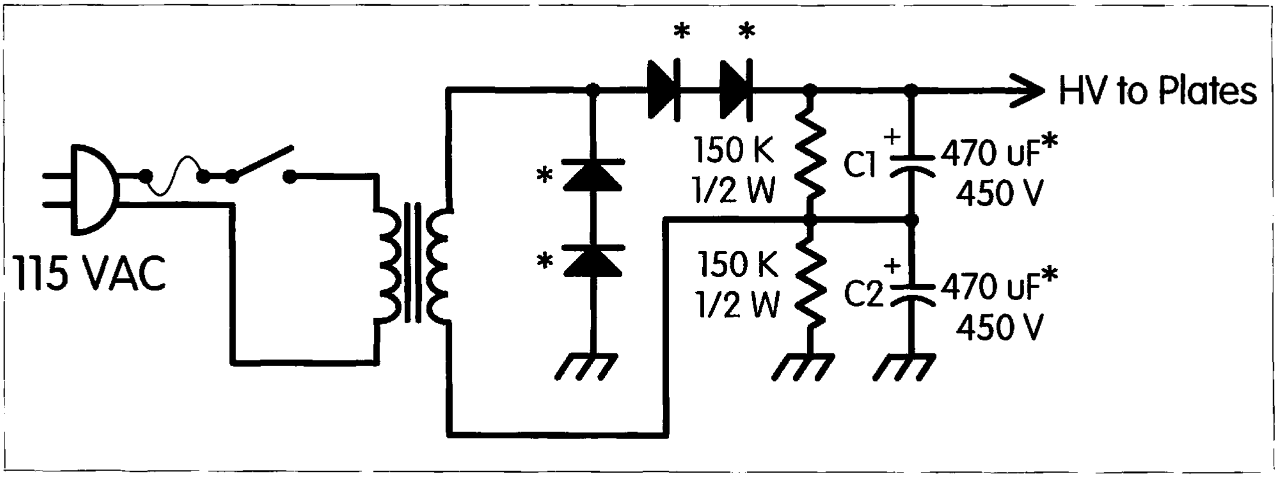


*Fig. 1. Typical power supply voltage doubler circuit. *Denotes components to be replaced.*

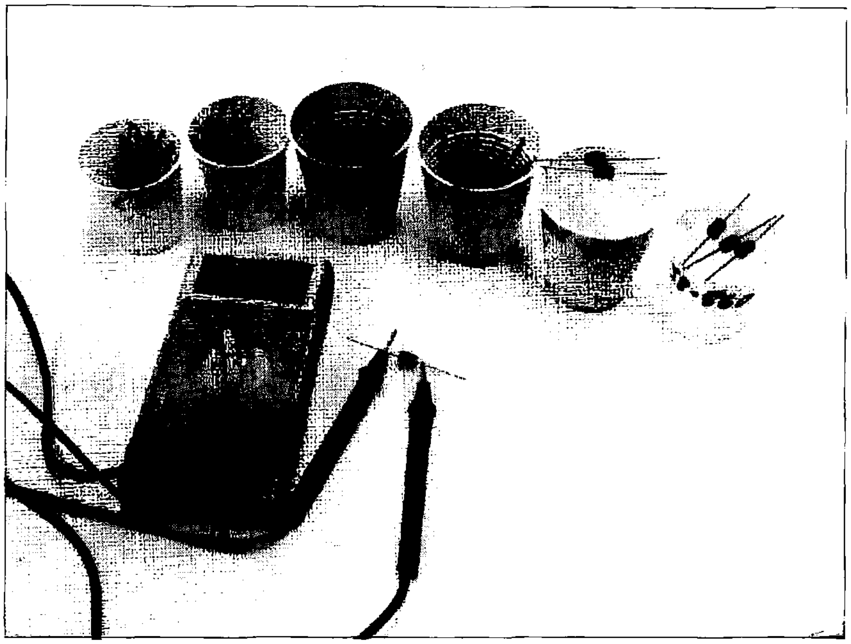


Photo B. It's a good practice to group power supply diodes by their value. In this case, the component with the .555 range readout will be placed in the second container from the right. Note how the majority of diodes cluster between .549–.551. Use this grouping for a long string of diodes in a full-wave bridge, since there are a sufficient number of closely related parts to complete the task.

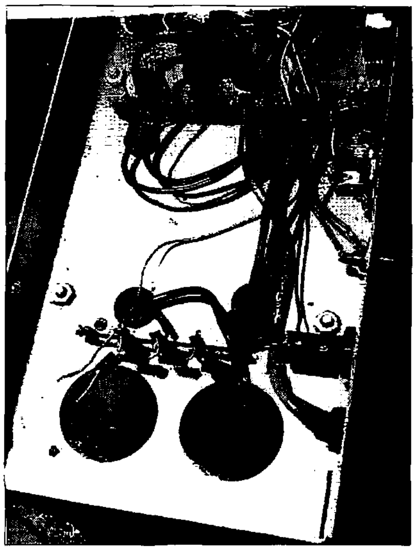


Photo C. Each of the four replacement voltage doubler diodes has been mounted on a terminal strip. Note that the banded ends are all pointed in the same direction. When the capacitor C1 is reinstalled, the high voltage plate wire (visible next to the diode) and that diode will be soldered to the (+) terminal. You will notice that one transformer lead passing through the grommet is attached at the midpoint of the diode string. The longer transformer lead to the right will be connected to the midpoint of the two capacitors (see text). The back side of the diode string is soldered to the grounded terminal strip.

At that price, don't hesitate to dust off that junker power supply and get it up and running for only a small cash outlay. If, on the other hand, you see a blown power supply junker rig being tailgated at a local hamfest, keep the secret to yourself about the cheap and easy fix, bring it home for a song, and get to work. If that sounds good to you, read on!

When to rebuild

You'll generally know you have a capacitor problem when your rig goes dead—usually in dramatic fashion. Accompanying the large bang is a puff of smoke and the acrid odor of fried components. It's a horrifying experience, but the dead silence and the lingering wisps of smoke are conclusive evidence that reconstructive surgery is definitely in the cards. You may be alerted to a less dramatic demise of your supply when you receive a signal report that indicates an audio hum level. However, no matter how the problem manifests itself, the repair procedures are straightforward and cost-effective.

The first thing to do before removing the bottom cover is to unplug the rig and wait for the filter capacitors to discharge fully. I can't imagine any set of circumstances when getting jolted would be considered a rewarding experience. Before opening up the case, check to determine if the fuse blew. Have a spare on hand when the rig is repaired and ready to be fired up.

Determine the location of the HV components by referring to the radio's schematic diagram and parts pictorial. Locate the high voltage rectifier section and look for evidence of leakage from the capacitors. Don't hesitate to smell around. The nose knows—and it will help you zero in on the culprit(s). The failure of these capacitors is generally what causes the problems, so examine this area first.

As the capacitors age, the semi-liquid insulating material begins to escape the confines of the capacitor. Eventually, the loss of the dielectric allows the foil plates to contact each other, resulting in a short circuit. The rest is history.

At other times during the capacitor's mid-life crisis, it may begin to bulge and ooze dielectric, signaling an impending problem. Eyeball the area immediately below the caps for the telltale sign (white crusty material) of leakage. The deterioration is similar to a leaking dry cell battery in the last throes of its life cycle.

Prepare yourself mentally for the replacement of all the HV rectifier capacitors even though only one cap may be at fault. You can be assured that the rest will soon follow. Spare yourself grief down the line and tackle the complete rebuilding job at the outset.

Which parts should I replace?

It's always a good idea, and not particularly expensive or time-consuming, to rebuild the entire portion of this circuit, including the replacement of all the complementary components. There aren't many additional parts and you won't have to worry that a reinstalled part will fail at some inopportune time.

If you're not rebuilding a Drake AC4 doubler or screen circuit, take a careful look at your particular wiring configuration. Note any slight differences in parts placement. It's important to remember that all power supply wiring begins with transformer AC that's rectified through a series of diodes. To filter the ripple, a high level of capacitance is utilized to purify the DC.

It's perfectly acceptable to substitute components with higher capacitance values and greater breakdown voltages, so don't be alarmed if the replacements' specs don't match up perfectly—but be careful not to substitute lower values in either the capacitance rating or the operating voltage. That's a definite no-no and the use of an underrated component only invites a circuit failure later on.

Before getting in there for the surgery, it's a good idea to make a quick pictorial of the circuit. Label your drawing with wire color codes, diode positioning, and capacitor ± orientation. You don't have to be Rembrandt. A crude drawing will suffice as long as it's detailed.

During the disassembly process, you will often find that resistors may have short leads, so attempt to desolder them—especially if they appear to be in good condition and replacement is not contemplated. Check out their ohmic values before reinstalling them in the circuit. Remove all excess solder and clipped leads from terminal strips. Cleaning up that area will make reassembly a breeze.

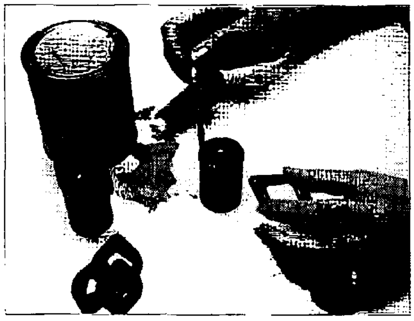


Photo D. *Use some two-part epoxy to affix the phenolic wafer to the capacitor. Note that the banded end with the elongated zeros is the negative terminal. If care is exercised, the wafers can be recycled.*

Match your diodes!

It's a good idea to purchase an extra supply of diodes. They don't go bad and it makes good sense to keep spares around the shack. Use your analog or digital VOM on the ohms (or Diode Check) scale to measure the front-to-back ratio and categorize each diode according to its value.

Manufacturing tolerances have been improved greatly, but these components will always work more efficiently when they are installed in closely matched groups. The range of readout values will become evident to you as you begin the sorting process. For the high voltage doubler circuit, select four diodes that have nearly identical parameters. Small differences are inconsequential.

When you're ready to install them in the circuit, make certain to observe the polarity. Follow the banding and arrow to determine orientation. Continually refer to your pictorial to double-check that the parts are correctly positioned. When wiring in the capacitors, the correct polarization is absolutely essential. That information should have been carefully marked on your layout drawing. You'll find the removed capacitors were mounted on a phenolic board and insulated from chassis ground.

After so many years, the wafers may be brittle. Exercise care when you straighten out the twist-lock tabs in order to remove the capacitor. Don't be alarmed if the wafer disintegrates. They're available inexpensively from a parts supplier listed at the end of this article. They can also be fashioned from a piece of perfboard, some Plexiglas™, or a small section of circuit board, provided you remove the copper cladding and—of course—the components.

You don't want a path to chassis ground. Since our replacement capacitors have no tabs, the easiest mounting procedure is to simply epoxy the capacitor to the wafer and reinstall the entire combination on the chassis utilizing the original mounting hardware.

Wire up the new capacitors following your pictorial. Keep the leads short. The hookup technique isn't overly critical, but it does make the job appear professionally wired. You'll find that the replacement capacitor has a single gray band imprinted on its side with an elongated zero to indicate negative (-) polarity. Keep the ± orientation in mind, since they will be series-connected with the minus of one terminal wired to the plus terminal of the other.

Again, positioning is not a critical factor. If you overlook this step it's not terribly serious, but it does reduce the wiring runs.

Begin by soldering one end of a jumper to the negative terminal of capacitor C1 and connect the other end to the positive terminal of C2 (don't solder at this time). Solder the remaining (negative) terminal of C2 to ground with a jumper. If you're simply replacing a single cap, the exchange is less complicated—but the polarity orientation must be observed.

Solder four diodes in series with the band/arrow facing toward the B+ terminating point. Solder the wire on the back end of the diode string to chassis ground. Attach the front lead of the diode string to the HV (B+) tie point. Use one of the ungrounded terminals on the strip or use the positive lead of C1 as the terminus.

At the diode midpoint, connect one lead from the power transformer. Connect the remaining transformer wire to the midpoint jumper lead on either the negative of C1 or the positive of C2. Solder the two bleeder resistors across each of the capacitor terminals, along with any other wires connected at these points. Make certain that the HV lead from the tube's plate circuit is attached at the HV output end.

Double-check your wiring before the smoke test!

If you don't consider yourself a power supply rebuilder whiz, get someone to check the correctness of your wiring. Failing that, take a walk around the block and return with a clear head and take another look. This will help to verify that all is in order. When you're certain the circuits are

Continued on page 86

Meet the Paddlette Micro Keyer

Who could imagine a knees-ier way?

Mike Bryce WB8VGE
955 Manchester Ave. SW
North Lawrence OH 44666

Although CW is no longer a requirement for becoming a ham radio operator, it's still a lot of fun. From users of the most expensive microprocessor-controlled rigs to QRP home-brew aficionados, hams still find a way to use CW.

But I'm surprised by how many hams are still pounding brass. I find it especially true when they are portable or mobile. It's not that they really want to carry a hand key around: there's just been nothing available to use—until now.

The Paddlette

The Paddlette is a very small iambic key. Its footprint is only one inch by one and three quarters inches. It weighs less than two ounces. It has only two moving parts. There are no springs or needle bearings or lock nuts used in the Paddlette. And, as my wife likes to say, "It's cute."

The Paddlette is made of solid brass and stainless steel. The base material is a composite plastic. Some of the finer details of the Paddlette include fine pitch adjustment screws—56 turns per inch, compared to the 32 turns used by other keyers. This allows you to adjust the gap smoothly from .016" down to zero. The magnetic hold-down feature keeps the Paddlette from walking all over the operating table.

Because the Paddlette is so small, a simple magnetic hold-down system is used. There are two magnetic surfaces: one on the Paddlette, the other removable. (These magnets are really the flexible magnetic strips of which refrigerator magnets are made.) The removable magnet has one of its sides coated with an adhesive. You stick this magnetic strip to the tabletop (or whatever else you want to stick it to) and the Paddlette then sticks to the strip. It's much easier done than said!

There is one drawback, however. You only have one try at attaching the adhesive magnetic strip. Once down, it's down! My Paddlette came with a

Photo A. *The Paddlette micro keyer.*

spare strip. The magnetic strip should be easy to find at any hobby or craft stores.

Using the Paddlette

You need to make the necessary connections between the Paddlette and the electronic keyer you plan to use. Three wires, three minutes. Now, all you have to do is give it a try!

I found the action of the Paddlette to be just fine for me for the most part, although the tension between the paddles is a bit weak for my taste.

If you're used to slapping a key around the desk, the Paddlette will be a disappointment.

No, it's not a precision-made German instrument, but it more than does the job.

It's small, so some of those ops with larger hands may find it hard to use. The Paddlette key paddle would be at home in portable or mobile use. It's cute, but I'm not sure about using it at home. Perhaps my worry is that I'd lose it in the clutter on my operating table.

There is one accessory that is quite unique to the Paddlette. It's a knee mounting plate. This gizmo attaches to your leg with a strip of Velcro™. You mount the Paddlette to the knee mount using the same magnetic system. Now you can run mobile CW from your car without having the keyer bounce all over the place. While I'm no mobile CW op, I did give it a try with my ICOM 706. It's a slick way of keeping the Paddlette in one spot as you travel down the road. The knee mount is an extra-cost option for the Paddlette.

I found the Paddlette iambic paddle key to fit right in with portable and mobile use, as well as my pocketbook ($38.50 postpaid, $44.95 for paddlette and knee mount). And if you don't mind its small size, it would work just fine at home, too. Besides that, it's cute!

For further information, contact the Paddlette Company, P.O. Box 6036, Edmonds WA 98026; (425) 743-1429. Bob Hammond KI7VY is the owner.

The Price Is Right

... and Ten-Tec's 1210 T-Kit is fun to put together, too.

R.W. Purkey W9NUP
7732 Red Oak Street
N. Richland Hills TX 76180

It has always seemed more than a little strange to me that in the era of orbiting amateur satellites, HF rigs with every bell and whistle imaginable, and new FM rigs being produced at the rate of "the radio-of-the-month club," manufacturers are still using the same old designs for SSB and CW from a decade ago for VHF and above. I don't know of any VHF rig that has DSP, for example. Not to mention that the price tag for these old designs is sometimes more than for a current-design HF rig. To overcome this, many amateurs have been using transverters.

Transverters are simply transmitting and receiving converters in one box. No audio, just RF. The most widely known type of receiving converter is the cable TV converter where multi-channel TV signals are on the input and the local oscillator changes frequency to the mixer resulting in output on channel 3 or 4. In the Amateur Service, the local oscillator is at a fixed frequency and the output is in a given bandwidth such as 28 to 30 MHz. A transmitting converter is simply the reverse. Now combine a receiving converter and a transmitting converter with one local oscillator and you have a transverter. As you can see, by using a transverter you retain all the features of your HF rig, such as DSP, scanning, FM, etc., without laying out major bucks to duplicate what you already have.

So how do I get a transverter?

Well, you can build or buy. If purchased ready-to-operate, some will cost as much as a low-end HF transceiver. That somewhat defeats the purpose and leaves us with building. There is much to be said for creating your own super whatever from scratch, but at VHF and above you had better have a lab or access to one. So let's talk kits. After 40 plus years of kit building I can tell you, from experience, that there are kits and then there are *kits*.

Ten-Tec, famous for their HF radios, has recently added kits to their product line under the label T-Kits. The latest addition is the Model 1210 two-meter transverter. Since I wanted to add two-meter SSB to my station at a reasonable price, I bought one. Considering the price, I thought this would be a lightweight design that might at least still turn out to be a good conversation piece at the next hamfest. Wrong!

What you get is a small (5-1/2 inches by 3-3/4 inches) double-sided PC board with plated-through holes and excellent silk screen and solder mask; two ICs; 13 transistors; 25 diodes; and a handful of resistors, capacitors, and inductors of various types, shapes, and sizes. Also included is a heavy steel case with aluminum chassis and heat sink. The cabinet is punched and painted, ready for mounting parts.

The assembly manual is great. In addition to easy, step-by-step instructions, there are color x-ray views of the PC board and test-as-you-build sections. The binder allows it to lie flat on the workbench—no using a brick to keep the book open with this one. Also provided is a table of test voltages at various points to aid in troubleshooting if required. The overall schematic diagram is on an 11- by 17-inch sheet of paper separate from the manual. On the reverse of the schematic are the locations of parts for the six construction phases and an overall view of the board. Although these pages are also in the manual, it keeps you from having to turn pages back to find component locations for the phase you are working on.

With the usual assortment of kit-builder's tools in hand, the 1210 went together in a smooth and orderly fashion. Testing is done at the completion of each phase and builds on previous construction. Reviewing these sections is an excellent aid for troubleshooting.

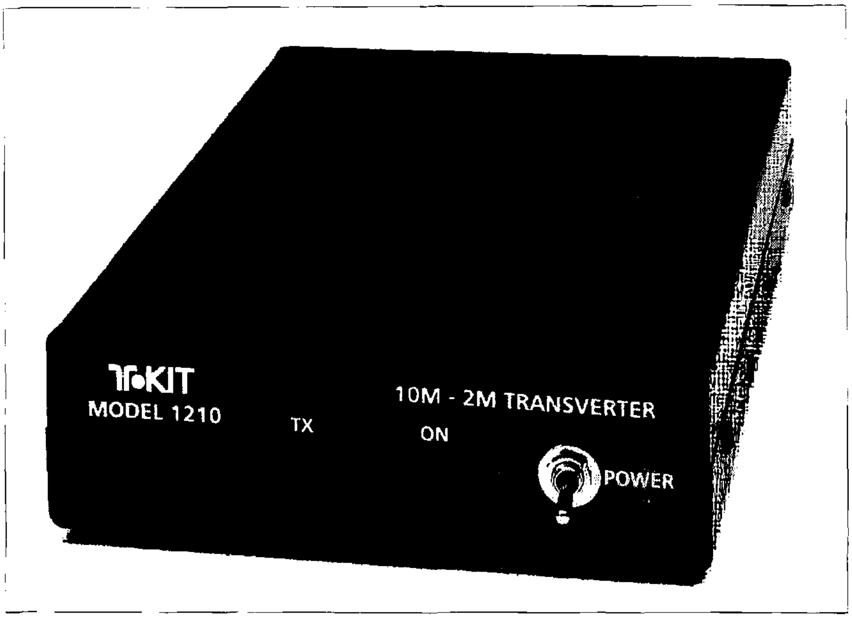


Photo A. The Ten-Tec T-Kit 1210.

The circuit design is solid and does not depend on "magic" or endless tweaking to make it work. Input voltage is specified at 13.8 volts DC at two amps on transmit for 10 watts output. Lower voltage can be used (11 to 12 volts), but power output will decrease. In the receive mode, a modest 100 mA is required.

A triple-output MB3756 regulator supplies voltages for the entire transverter with the exception of the last three stages of the transmitter amplifier (which are powered directly from the 13.8-volt source). RF-sensed switching of a few tenths of a watt places the transverter in transmit mode.

Provision is also made to enable the transmit side without an RF input. The 58-MHz crystal oscillator is doubled, filtered, and used for local oscillator injection to a double balanced mixer. The 28-MHz input/output of the mixer is amplified on receive and passed through a bandpass filter to the HF radio. The 10-meter signal supplied to the mixer can be anywhere between four and 20 watts, as an internal 20-watt load and adjustable ALC are part of the design. This feature becomes especially attractive when you realize that most transverters require the builder to construct external attenuators to provide milliwatts of power from a radio delivering watts.

On the two-meter side of the mixer, input signals are routed through two stages of filtering, one broadband and the other tuned, to a single MOSFET providing approximately 14 dB of gain with a two dB noise figure. Two tuned circuits couple the preamp to the mixer. In the transmit mode, a JFET and a triple-tuned bandpass filter amplify the mixer output to four more bipolar stages, boosting the output to 10 watts on CW, FM, or SSB while ensuring spectral purity.

Base bias to the final is controlled in the conventional manner of a diode used as a temperature sensor. On the collector side of the final are two stages of low pass filtering—one is a PCB stripline inductor, feeding a PIN diode T-R switch.

Unique to this VHF transverter design is the ALC. A sample of the output is rectified and sent to an op amp where it is compared to the power output control, thereby maintaining a constant output power. Input powers of four to 20 watts are acceptable. There are no relays and all switching is electronic with the exception of the on/off switch.

Construction begins with the 116-MHz local oscillator. As noted in the manual, a frequency counter is used to set this precisely on frequency. If you do not own or have access to a counter, a VHF scanner set to either 58 MHz or 116 MHz will get you by until you're on the air and can copy some other reference signal. Simply set the scanner to either frequency and tune the oscillator for best quieting. I rough-tuned mine with a counter and then, after the entire unit was working, set the HF radio to 30.000 MHz (146.000 MHz through the transverter) and used the counter and a dummy load to set my frequency. By this method, any errors in the HF rig frequency accuracy are accounted for. There is a test point on the board for tuning the LO for maximum output. It does require a DVM or VTVM and is also the only test point there is.

A signal generator for tuning the input and output of the RF preamplifier is preferred. If you do not have one, acceptable results may be obtained by tuning these coils while copying a local station and watching the S-meter on the HF radio. The post-mixer coils are very broad and do not require adjustment other than setting the slug to the top of the form.

There are no tricks to setting up the transmitter. There are three slug-tuned coils and two capacitors to adjust. Simply follow the manual and have a VHF SWR bridge and dummy load on the output. The pot for setting the bias on the final is a bit touchy, but with a little patience idling current can be set precisely.

What would any review be without nit-picking? OK, here it is.

First, the slug-tuned coils. The slugs are very fragile and thus require the correct tuning tool. The manual suggests using a plastic tool but does not make reference to a particular type. It also suggests using miniature screwdrivers.

I would avoid this method at all costs. A bit of a heavy hand and the slug is cracked. I did find that a General Electric® mobile radio plastic tool fit well. Perhaps in the future Ten-Tec will make available the correct tool or give the name of the model and supplier.

Second is the supplied wire. It is plastic-coated and therefore susceptible to heat from soldering irons. RG-174 is supplied with the kit for input and output connections and it too has a

plastic jacket and inner conductor insulator. Teflon™ wire and cable make for really neat-looking connections without the worry of melting the plastic. I found some miniature 50-ohm Teflon cable and wire that had been discarded in an old commercial two-way radio. Only a foot of cable is needed.

Third, remember I said the bias pot was a bit touchy? An inexpensive 10-turn PC-mount pot would make this job a snap.

Finally, in the instructions for two of the three hand-wound coils, you need to mount them on the board after having installed C-59 in Phase 3. If you install the coils first, the form can be used to hold the coil in place until after they are soldered, lessening the chance of distorting the coil or shorting turns.

Using the supplied crystal for the LO, the transverter operates from 144 MHz to 146 MHz with an HF rig used as the IF in the 28 MHz to 30 MHz range. If you wish, a 59-MHz crystal could be substituted in the LO, and with an HF transceiver operating in the 26-MHz to 30-MHz range the entire two-meter band could be covered.

There is no provision for bypassing the transverter for HF operation. The only way to go from VHF to HF is by changing the coax from the transverter input to the HF antenna. After eyeballing the case, I believe there is just enough room between the front panel and the PC board to install a small rotary switch. I think that an additional coax connector on the rear panel could be installed as well. The satellite operator who wishes to use this unit as an IF will have to install a coax connector on the rear panel and split the transmit and receive sides. These are issues that make for interesting future articles.

The Ten-Tec 1210 is one of those kits that is fun to put together. Mine was assembled in about 20 hours, from opening the box to putting it on the air. For the record, after completing alignment I can copy a .15 µV CW signal generated by my Cushman CE-3 using a Yaesu FT-840 as an IF. The FM 12 dB SINAD measurement indicates approximately .4 µV which is about what the FT-840 measures on 10 meters. With four watts out of the Yaesu, I measured 10.5 watts out on 146 MHz to a Bird Termaline. Other stations report the unit sounds as crisp and clean as the FT-840 on HF, which is the idea anyway.

Anyone can build this kit if he can follow directions. Depending on the builder's level of expertise, the time required may be longer or shorter. I would strongly urge anyone unfamiliar with kit building or soldering to find an Elmer to help out and give guidance. There are some areas of the PC board that are tight. Patience will pay off. Good lighting is essential to any project and in my case a jeweler's loupe and bifocals were a necessity. For those who do not feel comfortable building a kit, Ten-Tec plans to make the 1210 available wired and tested in the future.

Priced at $139, the kit is hard to beat. All the bells and whistles of your present HF radio are retained. If you have an old 10-meter rig lying around, or even a converted CB, this is an inexpensive way to get good performance on VHF.

Further information is readily available from Mr. Gary Green in the T-Kit department of Ten-Tec—phone (423) 453-7172. I found him to be pleasant, understanding, and informative before and after the sale. 73

Number 42 on your Feedback card

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the May issue, we should receive it by February 28. Provide a clear, concise summary of the essential details about your Special Event.

FEB 2

SUN CITY, AZ An amateur radio equipment auction will be held at 7 p.m. by the West Valley ARC at St. Clement of Rome Catholic Church Social Hall, 15800 Del Webb Blvd., Sun City AZ. Free admission. The club keeps 10% on equipment sales. Talk-in on 147.30+. Contact *George N7JSA at (602) 933-0854, or E-mail [watgl@juno.com].*

FEB 7

NORTH CHARLESTON, SC Stall High School in North Charleston, located near I-26 and Ashley Phosphate Rd., is the location for the 25th Annual and Original Charleston Hamfest and Computer Show, sponsored by the Charleston ARS. Doors open at 8:30 a.m. and close at 4 p.m. Setup is 5 p.m.–9 p.m. Fri., and after 6:30 a.m. Sat. 8 ft. tables are $8 in advance, $10 at the door, as long as they last. No tailgating allowed until all tables are sold inside. Make check payable to C.A.R.S. Hamfest Committee, and mail with an SASE (by Jan. 23rd), to *Jenny Myers WA4NGV, 2630 Dellwood Ave., Charleston SC 29405-6814.* Tickets are $5 at the door (includes 1 prize ticket). VE exams will be given on site. Please bring original and copy of your amateur license, any CSCEs you have, and two IDs, one with a photo. All testing will be on a walk-in basis and will begin at 12 noon. For further info call *Ed KE2D at (803) 871-4368; or E-mail [efrank@charleston.net];* or call *Doc W4MUR at (803) 884-5614.* For further hamfest info, contact *Jenny Myers WA4NGV at (803) 747-2324, or E-mail [brycemyers@aol.com].*

FEB 8

LATROBE, PA The Chestnut Ridge ARC Hamfest and Computer Show will be held 8 a.m.–3 p.m. at the American Legion, 1811 Ligonier St. in Latrobe. Take Route 30 to Route 982 north. Follow signs. Talk-in on 145.15(-600) K3JDU rptr. Admission $2, tables $10. Send payments to *CRARC, Box 175, Loyalhanna PA 15661-0175.*

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds in Mansfield, starting at 7 a.m. Tickets $4 in advance, $5 at the door. Tables $9 in advance, $12 at the door, if available. Reservation deadline is Jan. 15th. Talk-In on 146.34/.94 W8WE. For info, advance tickets/tables, send SASE to *Pat Ackerman N8YOB, 63 N. Illinois Ave., Mansfield OH 44905;* or phone *(419) 589-7133 after 6 p.m. EST.*

FEB 14

TRAVERSE CITY, MI Cherryland ARC's 24th Annual Swap-n-Shop will be held at Immaculate Conception Middle School, 8 a.m–12 noon. VE exams will be held following the Swap, at 1 p.m. and 4 p.m. Pre-register, or register at Swap only. Talk-In on 146.86. Call *Joe W8TVT at (616) 947-8555;* or *Chuck W8SGR at (616) 946-5312.*

FEB 15

BRIGHTON, CO The Aurora Repeater Assn. will hold its annual Swapfest from 8 a.m.–2 p.m. local time, at the Adams County Fairgrounds, 9755 Henderson Rd., in Brighton. VE exams available. Talk-In on the N7PVN/R 147.15(+). Contact *Wayne Heinen NØPOH, P.O. Box 473411, Aurora CO 80047-3411; Tel. (303) 699-6335; or E-mail [nrclog@aol.com].*

ROCK ISLAND, IL The 27th annual Davenport (Iowa) ARC Hamfest/Computer Show will be held at the QCCA Expo Center, 2621 4th Ave., Rock Island IL. Handicapped accessibility. Free parking. The hamfest features a large indoor flea market and commercial exhibits; food available, door prizes. Talk-In on the WØBXR 146.28/.88 and 146.04/.64 rptrs. Tickets are $5 in advance, $6 at the door (under 14 free). For more info, send an SASE to *Kent Williams K9UQI, 4245 10th St., East Moline IL 61244-4154; voice (309) 796-0718 (4 p.m.–9 p.m. only, please); FAX (309) 796-0629 (24-hr.); or E-mail [k9uqi@arcsupport.com].*

FEB 21

RICKREALL, OR The Salem Repeater Assn. and the Oregon Coast Emergency Repeater Assn., Inc., will sponsor the 1998 Salem Hamfair and Computer/Electronic Swapmeet at the Polk County Fairgrounds in Rickreall. Doors will be open 9 a.m.–3:30 p.m. Swap table setup will be Fri., Feb. 20th, 6 p.m.–8 p.m., and Sat., Feb. 21st at 7 a.m. Self-contained RV spaces available. Features include swap tables, commercial dealers, meetings and seminars. For more info, contact *Evan Burroughs N7IFJ at (503) 585-5924.* To download a copy of the flyer and pre-registration form, surf the net for *[http://teleport.com/~n7ifj/sraflyer.htm].*

FEB 21–22

CINCINNATI, OH The 17th annual Great Lakes Division and Computer Convention (formerly Cincinnati ARRL 1998), will be held at Cincinnati Gardens and Exposition Center. A 24 hr., 7 day-a-week phone line is already in operation for vendors and others seeking info. Call *(513) 661-0201.* If you wish to fax the convention, please use *(513) 531-3834.* These lines will inform you regarding vendors, tickets, flea market spaces, and forums. Cincinnati Bell's Answer-Link will allow the appropriate convention staffer to return calls and give the latest information quickly.

FEB 22

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will hold its 44th annual Hamfest at Emidio's Party Center, 48 Bath Rd. (corner of State and Bath, approx. 6 miles south of the Ohio Tpk.). The doors will be open 8 a.m.–2 p.m. Admission $4 in advance, $5 at the door. Tables reserved before Feb. 6th are $8; at the door, if available, $10. Please call for details regarding VE exams. Contact *Dan Adkinson KC8CFJ, P.O. Box 2222, Stow OH 44224; Tel. (330) 923-9045; or E-mail [hamfest@neo.lrum.com].* Talk-In on 147.87/.27 W8VPV.

DEARBORN, MI The Livonia ARC will present its 28th Annual Swap 'n' Shop, 8 a.m.–3 p.m. at the Dearborn Civic Center, Dearborn MI. For info, send a 4" x 9" SASE c/o *Neil Coffin WA8GWL, Livonia ARC, P.O. Box 51532, Livonia MI 48151-5532;* or call the club phone line, *(313) 261-5486.* Check the Web page at *[www.larc.mi.org].*

FREEPORT, NY The Long Island Mobile ARC Indoor Hamfair will be held rain, snow, or shine, at Freeport Armory, Babylon Turnpike, Freeport NY. The event will be open 9 a.m.–2 p.m., and features amateur radio equipment, computers, dealers, ARRL and LIMARC information, CB equipment, TV, and a VHF tune-up clinic. General admission $6, children free. Vendors: All spaces $25 (includes one 6 ft. table and admits one person). Special close parking and/or drop off area for vendors. Vendors admitted at 7 a.m. Advance registration only. No day-of-sale spaces. For a reservation form, E-mail *Hamfest Chairman Rich N2WJL at [N2WJL @juno.com].* Send your check to *LIMARC, P.O. Box 392, Levittown NY 11756-0392.* Limited selling space—only some have electricity. Free parking for buyers. For more info, call the LIMARC 24-hr infoline at *(516) 520-9311;* or write *LIMARC* at the address above. Check out their Web page at *[http://members.aol.com/RaySk/LIMARC1.HTML].*

FEB 28

LAPORTE, IN The Cabin Fever Hamfest, sponsored by the LaPorte ARC, will be held 7 a.m.–1 p.m. at the LaPorte Civic Center. The event will also feature computers. Admission $5. Tables $5 each. Talk-In on K9JSI 146.610

(131.8 pi) and 146.520 simplex. For further details, contact *John N9ROH, LPARC, P.O. Box 30, LaPorte IN 46352. Tel. (219) 326-7182 evenings.*

MILTON, VT The Northern Vermont Winter Hamfest, sponsored by the Radio Amateurs of Northern Vermont, will be held 8 a.m.–3 p.m., at Milton High School, Route 7, in Milton. Features include a flea market, auction, dealers, book sales, forums and exhibits. VE exams will be given at 9 a.m. and 2 p.m. Commercial exams at 2 p.m. Admission is $3; free for under 18 years. Tables are free while they last. Please call for large setups. Talk-in on 145.15 rptr. Contact *W1SJ at (802) 879-6589; E-mail [wb2jsj@vbi.champlain.edu].* Check the Web for *[http://www.ranv.together.com].*

MAR 15

MAUMEE, OH The Toledo Mobile Radio Assn. (TMRA) will hold their 43rd Annual Hamfest/Computer Fair, 8 a.m.–3 p.m., at the Lucas County Recreation Center, 2901 Key Street, in Maumee. For details send SASE to *TMRA, P.O. Box 273, Toledo OH 43697-0273;* or *Paul Hanslik N8XDB, P.O. Box 273, Toledo OH 43697-0273. Tel. (419) 243-3836.*

MAR 21–22

BETHPAGE, NY The Long Island Mobile ARC will present a weekend Ham Radio Course at Briarcliffe College, 1055 Stewart Ave., Bethpage, NY, Sat., Mar. 21st through Sun., Mar. 22nd, 9 a.m.–6 p.m., for anyone interested in obtaining their entry level amateur radio license. There is no pre-requisite for registering, just a desire to become a ham. No minimum age limit, but we recommend age 10 and above. The cost per person is $35. This includes the workbook, lunch each day, and refreshments at breaks. It does not include the exam cost of $6.25. There will be a number of instructors, including LIMARC Past President Norm Wesler K2YEW, current LIMARC President George Tranos N2GA, and current Vice President Rob Todaro N2JIX. For more info, please call the LIMARC 24-hour info line at *(516) 520-9311;* or E-mail to *N2GA@aol.com.* Registration is limited, so please reserve now to secure your spot. Indicate age if less than 18. Please make checks payable to *LIMARC* for $35 per person. Include name, address, phone, and E-mail address. Send to *LIMARC Weekend Class, P.O. Box 392, Levittown NY 11756.*

MAR 22

GRAYSLAKE, IL The Libertyville and Mundelein ARS, assisted by the North Shore Radio Club, will hold "LAMARSFEST '98" at the Lake County IL Fairgrounds in Grayslake. This large indoor radio, computer, and electronic swapfest will be open 8 a.m.–2 p.m.; setup is at 6 a.m. Advance commercial setup by arrangement. Admission is $5 at the door. Swapfest tables $10 each. Wall tables $15. Commercial tables $25. Table reservations until March 14th. No additional charge for power. VE Exams. No tailgating. For info and reservations, contact Dave *Gudewicz KB9KDA, LAMARSFEST 98, 5 Brigantine Lane, Grayslake IL 60030. Tel. (847)-937-8227 until 9 p.m.* Talk-In on 147.345(+) NSRC rptr., and 146.52 simplex.

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their Hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

FEB 14

FARGO, ND The Red River Radio Amateur Club and the Kiwanis Club of Fargo will operate KØZWG in celebration of the 16th Anniversary of their cooperative Handi-Ham Project. The station will operate during the 40th annual Kiwanis Pancake Carnival. Operation will be from the downtown Civic Center, Centennial Hall, 8 a.m.–5 p.m. CST (1400Z–2300Z). Operation will be in the lower 25 kHz of the General 20 and 15 meter bands—both CW and SSB. For QSL, please send QSL and SASE to Mr. Jim Mowery *KØZWG, Horizons Manor, 2500 Broadway, #1006, Fargo ND 58102 USA.*

FEB 14–15

ALEXANDRIA, VA The Mount Vernon ARC will operate K4US 1500Z–2200Z to commemorate George Washington's Birthday. Operation will be in the lower General 80–15 meter phone subbands and 30–17 meter CW. For a certificate, send QSL and a 9" x 12" SASE to *MVARC, P.O. Box 7234, Alexandria VA 22307 USA.*

APACHE JUNCTION, AZ The Ocotillo Amateur Radio Group will operate Station KJ7FG, 1400 UTC Feb. 14th–2400 UTC Feb. 15th, in celebration of the 86th Anniversary of the Statehood of Arizona. Operation will be 20 meters only, 14.260/.360. QSL for a certificate with a 9" x 12" SASE to *K6RLS, 5228 N. Idaho Rd., Apache Junction AZ 85219.*

FEB 20–22

MARQUETTE, MI The Hiawatha ARS will operate K8LOD, Feb. 20th–Feb. 22nd, in the General portion of 80, 40, and 20 meters, in conjunction with the UP 200 Sled Dog Championship. In order to get a commemorative certificate, send an SASE to *Rich Schwenke N8GBA, 21 Smith Lane, Marquette MI 49855.*

NEVER SAY DIE

Continued from page 6

2000. René says the Earth has no bulge and thus can easily be flipped so the poles move to the equator. Noone expects about the same thing, but just with the crust sliding. Either way all hell will break loose, with mile-high waves, and lots of earthquakes, and volcanoes blackening the skies. Well, at least he's giving us a couple more years to worry about it than Scallion is.

The worst worrywart seems to be Ed Dames, who says the Big One will hit in April 1999. In late November he predicted a massive solar flare to hit us in December which would screw things up, but not kill us. The 1999 flare, he said, would wipe out all life above the ground. Hey, where's my shovel? Dames said that he and his family were headed for the South Pacific in the next few days.

Scientists Unconvinced

A recent Gallup™ poll of their survey of several thousand scientists reported that only 19% have so far been convinced that global warming is actually taking place. So, despite the hysteria of some political groups, if the end of the world is coming, it isn't likely to be from our CO_2 emissions. Bad science.

The Bottom Line?

Will we be nuked by terrorists? Biological or chemical attacks? Shifting polar areas? A new ice age? A third world war starting in the Middle East? A killer solar flare? Or will we continue on as we have with our school, health care, and political systems gradually worsening? Watch the evening TV news for developments—unless all the radio and TV stations get blasted off the air, then see what, if anything, you can find on the ham bands.

Well, in many ways we've made a mess of things, so maybe wiping the slate clean and starting over wouldn't be a bad idea.

The biggest bummer may be that Saddam, buried deep underground in a bunker, may be one of the few survivors.

Prophecy

The more I read about prophets, the more bewildered I get. Like you (I suspect), I'm so totally tied to the physical experience of time that I don't understand how time travel can be possible. The clock ticks off the seconds—then the minutes and hours. There is no going back, except in memory—which is a pretty good time machine in a way. Being a pragmatist, I'm not a disbeliever in time travel, I just

Continued on page 49

Electronic Construction from A to Z

Conclusion: You too can be Mr. Fix-It!

Marshall G. Emm N1FN/VK5FN
2460 S. Moline Way
Aurora CO 80014
[n1fn@mtechnologies.com]

This is the last article in our series on basic electronic construction, and I hope you don't even need to read it! If you've been with me from the start, you probably have a brand-new, working, VM-110 AC Voltage Monitor (see Parts 1–3), installed neatly in an enclosure with a nice label.

But what if it doesn't work? Don't despair. The odds are very good that you can figure out what is wrong and fix it yourself, through a process we mistakemakers refer to as "troubleshooting."

A sensible approach is to ask yourself, "What did I do wrong?" If you can determine that you did nothing wrong, look for a problem in the circuit board, and then a faulty component. If you still haven't turned up the problem, it's time to send it back to its maker. Odds are pretty good you'll get it back with a polite note that it was your fault after all—they found a goof that you missed in the umpteen times you checked everything.

Step One: Take a Break

Seriously! You are probably "too close" to your project and if you saw something one way when you installed it you will probably see it the same way when you check it—unless you have let a bit of time go by and can approach the problem with a fresh eye.

People who write for a living often think they can adequately proofread their own material. People who edit for a living know better. And I know from personal experience that I often find mistakes in an article when in comes back in proof form. It takes a while for that to happen, so my eyes see what is actually on the page rather than what I "think" I put there.

Exactly the same principle applies in electronic construction. You checked the diode when you installed it, and it looked right when you checked it. Forty-eight hours later you're wondering how you could possibly have put the darned thing in backwards.

There is also a certain amount of anxiety associated with troubleshooting your own work. You put a lot of time and effort into building it, not to mention dollars, and it's all wasted if the thing doesn't work. This anxiety makes it easy to jump to conclusions, take shortcuts in checking your work, and seek someone else to put the blame on.

If you just heave a big sigh and put your project away for a day or two before trying to fix it, you will come back to it with a fresh eye and a good attitude, and much better prospects for success.

Let me give you a concrete example. I recently finished a project late one night and was just devastated when it didn't work. My immediate inclination was to tear into it and fix it immediately, but instead I heaved a big sigh, put it on the shelf, and forgot about it for two or three days. When I came back to it ... well, it, um ... it worked. I'd only made one tiny mistake the first night—I forgot to turn the power supply on. OK, my face is a little red over that—but maybe it will help you to avoid similar problems.

The procedures I am going to describe are just guidelines. It's a system that works for me, but I take liberties with it sometimes and you shouldn't feel that you have to do everything I'm going to describe, or do it in the same order.

Don't be embarrassed to ask for help. If you know somebody who is a builder, ask him to cast an eye over your work. You might be surprised how easily someone else can see a problem that you have overlooked.

And most of your peers are going to be delighted to be asked, because most hams are helpful and it's also an opportunity to show off.

Lazy Man's Step Two: Check Components and Connections

I call this the lazy man's approach because it is easy, but it is also time-consuming. You check all of the components and soldering (but don't try to do both at the same time).

In checking the components, you need to check three things—the value, the orientation (for polarized components like diodes and electrolytic caps), and that they are installed in the correct location. Go through the instructions step by step and check each step off as you go through the sequence. You may also wish to consider going through the instructions in reverse order (just like adding a column of numbers), to give you a slightly different perspective.

Pay particular attention to any "left-over" holes on the board. It's quite possible that there are supposed to be some empty holes because the design of the circuit has been changed or to make provision for options and modification, or testing. It's also possible that you left a component out! Hold the board up to a light and look for the holes.

In checking the soldering, use as strong a magnifying glass as you can find (a 10x loupe is perfect) under good light. What you are looking for are poor connections (cold joints, or connections with a rough finish or no sign of solder flowing up the component lead) and solder bridges—solder which has flowed between adjacent tracks or connection points. If one is available, refer to the solder track diagram when you can't be sure whether a connection is intended. If you don't have the solder track artwork you will have to refer back to the schematic, which can be a real pain. So here's a hint for your next project—if a copy of the art is not supplied, photocopy the solder side of the circuit board before you start. When you are checking the soldering, you are looking at mechanical detail without any regard for "where you are" in the circuit—start at one corner of the board and work your way through to the other side in reasonable stages so you can be sure you have examined every square millimeter.

Sometimes you will encounter a "whisker" solder bridge or the tiniest trace of circuit board material across two tracks. Use your hobby knife, or the edge of a small screwdriver, or (best of all if you have one) a dental pick to scrape the board material between the tracks to remove the bridge. Often I have been able, literally, to *feel* a bit of solder or conductive material that was all but invisible to the naked eye.

If you have checked all the components and all of the soldering and you haven't found anything to fix, you have two choices—send it back to the maker or start over with the method outlined below.

Probably you will get your circuit working with the above approach, but Murphy's law says no matter what order you check your work in, the problem will turn out to be in the very last component or joint that you check. You can save a lot of time by applying the following method, especially with more complex circuits.

The *Real* Step Two: Isolate the Problem

You don't have to be an electronics engineer to have some idea of what the various parts of the circuit do. The instructions probably tell you in general terms, and common sense can be pretty useful too. And it's quite likely that some parts of the circuit are working perfectly. We're going to go through this in stages, and in some cases if you detect a problem you will immediately see the cause and the solution. But if not, don't despair—isolating the problem is only the first of a lot of things we can do.

Look at the power supply first. Make sure that you are connecting the correct voltage, with the correct polarity.

Locate circuit ground, because you will need to connect to it for many measurements. Incorrect connections to it are a common source of problems. Circuit ground, or the "ground plane" of the circuit, is usually a large-ish track, often all the way around, or

most of the way around, the perimeter of the board, with interior tracks directly connected to it. When in doubt, use your multimeter to check continuity back to the power supply connection.

With the power supply turned off or disconnected from the circuit, set your VOM (volt-ohm-milliammeter) or DVM (digital volt meter) on its continuity or ohms setting and check whether there is continuity across the positive and negative power supply connections. If there is, then you almost certainly have a dead short and should look for a solder bridge between a supply track and ground.

Turn the power supply on (but don't connect it to the circuit yet) and measure the voltage to be sure that it is the required voltage for the circuit. If you are using a battery, check its voltage. Then connect power to the circuit and recheck the voltage on the plus and minus tracks beyond the actual connection points (thus proving that the power supply connection is OK).

If you haven't turned up anything so far (or if you have found a problem, and fixed it, but it still won't play), measure the current drawn by the device, by connecting an ammeter in series with the positive voltage supply. Be careful, because many inexpensive multimeters will only measure a very low level of current, e.g., 100 mA. Make sure your meter is rated for current greater than the maximum current that your device should draw. If you are drawing no current, then you have the opposite problem from a dead short. You have an open circuit somewhere in the power supply end of the circuit. If you are drawing current but not the correct amount, you have a problem with one or more of the later parts of the circuit.

Once you've performed the steps described above, it's time to get down to brass tacks. There are two approaches you can take, and sometimes both are necessary. You can follow the power, and you can follow the signal.

For any part of your circuit to work, it will have either power supply and usage characteristics, or some sort of input and output, or both. In the case of an audio amplifier for example, you have signal in, signal out, and power.

To check power supply and usage characteristics, it helps to have a chart of voltages at various test points such as the pins of integrated circuit chips. If your project included such a chart, you probably won't need much more. Just check the indicated voltages and look for a problem in the immediate area of the test point if the voltage is not as specified.

If you don't have a chart of reference voltages, you can still achieve much the same effect by tracing the power supply lines on the schematic diagram. It's quite possible that you won't know exactly what voltage should appear at a given point, but if there is no voltage at all you have located a problem.

You can also check for continuity between many integrated circuit pins and ground (with the power disconnected, of course). Look at the circuit diagram, find the grounding points, and check them. An open or missing connection to ground can be just as problematic as an "extra" one!

"You can follow the power, and you can follow the signal."

To follow the signal, you probably need to know a bit more about how the circuit works. There are three kinds of signals that you may be able work with—audio, RF, and digital.

Audio signal tracing can be done with a pair of headphones connected to a pair of test leads. Probe the circuit at various points along the signal path by connecting the grounded or "common" side of the headphones to the circuit board ground, and the "hot" connection (usually the tip on a standard phone plug) to the test point. You can start at either end of the audio path. If you are starting at the source, you follow the signal until it disappears, which tells you approximately where the problem is. If you are starting at the output, you follow the path until the signal appears, which tells you the same thing.

RF signal tracing is a bit more difficult. Two possible approaches are to use a simple diode and capacitor circuit as detailed in The ARRL Handbook (or of course an RF voltage probe if you have one). The probe circuit rectifies the RF and produces a DC voltage which can be measured with your multimeter. Be careful, though, not to confuse RF and DC voltages, because both will be present at some points in the circuit.

The second approach is to bypass suspect stages. If you are working with a receiver, for example, you can find the input and output points for a filter, and use a clip lead to bypass the entire filter. If you suddenly have a working receiver, you know the problem is in the filter stage.

Digital signal tracing is generally beyond the scope of this article, but in many simple circuits you can easily determine whether a specific point should be "on" or "high" (commonly +5 V) or "off" or "low" (commonly less than +1 V). For example, the keying output of an electronic keyer is controlled by one specific pin on one specific chip, which is "high" when a dit or dah is being sent.

Step Three: Clean It Up!

No matter how carefully you solder, there is bound to be some flux residue on the track side of the board. Depending on how much there is, and what type of flux it is, it may be difficult to see problems. I know I said (in Part 1, November 1997) that you probably shouldn't bother removing the flux, but it's a lot easier to work with a clean board when you are trying to find a problem. It's fine with me if you want to clean the board before performing step two (above), but keep in mind that cleaning the board may introduce problems that weren't there before.

If you are using ordinary resin-core solder, you can buy a very expensive solder flux remover at your local radio parts store, but the easiest material to remove excess flux with is acetone. Acetone is probably better known (and certainly more readily available) as nail polish remover. You'll probably find several varieties in your local grocery or drug store, and this is one of those cases where a brand name means nothing. Buy the cheapest they have, but do look for one that is described as

"non-oily" or lists only acetone on the ingredients label. This time we're lucky, because it's usually the more expensive name brands that have the added oils, emollients, and perfumes. If you can't find a pure acetone nail polish remover on the shelf, ask the pharmacist—he'll probably sell you a small bottle of it at a very reasonable price. And don't overlook your neighborhood hardware superstore, where you'll probably find a quart bottle of acetone for about the same price as four ounces of nail polish remover.

Here's how I do it. I put the circuit board in a metal baking dish (a/k/a a cake pan), solder side up, and pour a generous amount of acetone over it. Quickly, before the acetone evaporates, I scrub over the board with an old toothbrush. The process is repeated until the entire board has been done, at which point the areas done first will be dry and showing a milky haze. This is a very thin coating of dissolved and redeposited flux, and it should be removed by giving the board another rinse in acetone. Make sure the board is thoroughly dry before you take it back to the workbench and try to do anything with it.

If you are not using resin-core solder, you should use whatever solvent is recommended by the manufacturer. If you are using a water-soluble flux, for example, you can clean the board with warm water (with a small amount of detergent in it), but you must expect it will take longer for the board to dry than if you use a volatile solvent. And you *must* wait until the board is thoroughly dry before trying to do anything else with it.

Step Four: Find and Fix

Assuming you have localized the problem, or determined that it is in a particular area of the circuit, it should be relatively easy to narrow it down even further to a specific component or circuit path.

Since the odds are still pretty good that the problem is a soldering fault, you might want to try the "wiggle test." Basically, you just press on each component with a fingertip and wiggle it a bit to see if the circuit suddenly starts to function. Note that this should only be done with *low power* circuits! In fact, you should probably not use your fingertip in the first place. Use the eraser end of a pencil, or a nonconducting tuning tool.

Look at the components and the soldering again, and see if you can find:

- a solder bridge
- a poor connection
- an incorrect component value
- an incorrect component orientation, or
- an incorrect component placement.

If you don't find anything wrong, then it is time to see whether you have a faulty component. There are three things you can do to check components.

Measure the value. You will need to examine the schematic to determine whether the component can be measured "in circuit." In many cases a component will have to be removed from the circuit, although sometimes (e.g., with most resistors) you can get away with just unsoldering one end of it.

Substitute another component. If you happen to have another component of the same value, you can swap it in and see if it fixes the problem. Often you can use a "close" value as a temporary substitute if you can't find an exact match, and if you are lucky that will tell you whether the original component was in fact faulty.

Bridge the component. You need to be careful with this one, especially with components in the power circuit, but often you can safely bypass a component long enough to see if doing so will make the circuit function, in which case the component is probably faulty.

Naturally, there will be circumstances where it is absolutely impossible to determine that a component is faulty. Examples that come immediately to mind are ceramic resonators, integrated circuits, and many transistors. If you suspect that such a component is faulty, and can't prove it by swapping in another one from your junk box, it's time to get in touch with the manufacturer.

Lazy Man's Step Five

If you are tired of messing with it, and have the money, and/or are just downright lazy, by all means pack it up

and send it back to the manufacturer. Check the documentation for instructions which will often tell you the specific fee that must be sent, or whether you need to arrange for a "return authorization."

The *Real* Step Five

Don't give up just yet! If you've made it this far and your project still doesn't work, it is time to get in touch with the manufacturer, but you may still be able to fix it with a bit of help. Call them, or send them an E-mail, or write to them, with as complete a description of the problem as possible, and what you have done to try to fix it.

Most people who sell kits to (or design projects for) the amateur radio community do so as a labor of love, and they want you to succeed!

Many of them will fix a nonfunctioning kit without charge, or at a very reasonable cost, and often they will send you replacement parts or spend so much time trying to help you that they couldn't possibly break even on that particular sale.

Here are some of the reasons you should get in touch before sending it back:

- Someone else may have had the same problem and there is a known "fix."
- The manufacturer may have found out that one of the instructions can be misinterpreted.
- At the very least, the designer of the project will understand the circuit fully and can often provide an accurate diagnosis based on your description of the problem.

If you have to send it back, don't sweat it. It has happened to just about all of us, including yours truly. There's no shame in admitting you are not an electronics engineer (unless, of course, you have a degree that says you are!). And if it turns out that it was something you messed up, well, we learn from our mistakes ...

Most suppliers will meet you halfway, too. If the problem was their fault, they won't charge you for the repair (and some won't even charge you the freight to get it back to you). If it was your fault, then you certainly shouldn't mind paying a reasonable price for a remedy. In all my years of building kits, I have had four or five which have required help from the maker (up to and including sending it back), one that I didn't bother sending back because it was cheaper and easier to order another one and start over (the second one worked and gave me a comparison unit to get the first one going!), and only one that resulted in an irreconcilable difference of opinion and a demand for a refund.

Here's a Horror Story

That one unfortunate situation is worth dwelling on, but please note that these were folks whose kits have nothing to do with ham radio and therefore will probably not be encountered by most of you.

I won't name them, because I'm sure they have either cleaned up their act by now or gone out of business. The kit was a power supply, and the problem was a faulty pass transistor and, probably, a fault in the basic design.

Using most of the techniques described above, I determined that I had built it properly, but the malfunction pointed to the transistor. I swapped another one in and it still didn't work, so I decided to send it back after speaking to one of their "technical" people. There wasn't a whole lot of communication because the guy didn't speak much English, but he did authorize me to send it back on the understanding that I would pay if the problem was my fault.

There was just something the slightest bit "off" about these people, so I put the original transistor back in, double-checked the soldering, and photographed both sides of the board before sending it back.

They "fixed" it, charged my credit card $35 (the kit cost $29 to start with!), and said the problem was a cold solder joint on the pass transistor. Well, guess what? I had a close-up photograph that clearly showed the soldering on the pass transistor, which was just fine. I had a close-up photograph of the other side of the board that showed they had in fact replaced the pass transistor. And, to put the icing on the cake, the thing still didn't work.

I called them up and they denied that they had done anything but resolder the connections, and claimed that it was working when it left them.

When I told them I had a photograph they started to give me the old shuck 'n' jive, so I demanded a refund, which they refused. So I got the refund through the credit card company after a whole bunch of paperwork.

The moral of the story? There are at least two:

- Know whom you're dealing with, and if it is someone outside the normal range of amateur radio suppliers, take precautions.
- As with any transaction, on the Internet or at your local gas station, the best form of credit card security is a card provider who will go to bat for you.

Wrapping it Up

Your kit probably worked the first time you tried it. If it didn't, you were probably able to fix it all by yourself. If you couldn't, then you've probably sent it back and got it fixed, perhaps paying a fee which you can regard as a tuition payment.

In any case, you're finished with it now and can start thinking about that next project—perhaps a keyer, or an audio amplifier, or even a transceiver!

As I write this I have already started to receive a considerable amount of correspondence resulting from Part 1 back in the November issue of 73. I understand that many of you have even sent in the "feedback" card (thanks!). When I started this series, I was concerned that it would be difficult to find the right level of detail for the beginning kit builder, but I am highly gratified by the response and just thrilled that it has convinced some of you that you can do it!

I hope that when you build your next project, you will write it up for publication. You don't have to be an expert, and you don't have to be a "writer." What counts is your ability and willingness to share your experience. 73 de N1FN.

NEVER SAY DIE

Continued from page 43

don't understand what the rules may be for those who have achieved it—and we have some strong hints that there are time travelers.

But what about people who seem to be able to predict the future? How is this possible? If the future is written, then in how much detail? Can we change future events?

You've read about Nostradamus and his prophecies. They are truly amazing—if you haven't read about them, get a book on his quatrains. How could he predict Hitler so accurately 400 years earlier? Or the exact date, 200 years later, that someone would exhume his bones?

Washington reported that at his lowest point at Valley Forge he was visited by an angel who showed him that the revolution would be won and a union formed. He was also shown the Civil War and that the North would win.

Then there's Dannion Brinkley, who died twice and went to Heaven, where he was shown the future, as reported in *Into The Light*. It's reviewed in my *Guide*. He was shown the Gulf War, including the date, place and the combatants—and he reported this 20 years before the war.

I've had Gypsies tell me about things that would happen later, and they did, just as predicted. I remember a tea leaf reader on Fifth Avenue in New York. I'd just joined the Navy in 1942, but the navy base was out of uniforms so they gave me three weeks' leave. I was scheduled to go to Bliss Electrical School (now Montgomery College) in Maryland in a few weeks to learn about electronics and radar. The Gypsy looked at my tea leaves and said it was strange. Though I was in civilian clothes she saw me in uniform. At that time it was illegal for the military to wear civvies without special permission. She saw me going into a big building with many others and coming out as #1. I didn't know what she meant, but when I graduated from Bliss a few months later I'd won top honors.

I'd always been a C- student in high school and college, so this was something I never would have predicted.

The more I've read, the more I've found reports of prophets who have been very successful in predicting the future. One book, *Cosmology*, by Bevy Jaeger, explains how anyone can develop the ability to predict the future. If you've been brainwashed by skeptics into thinking that dowsing is baloney, then you need to read some books on the subject and start trying it yourself. With some experience just about anyone can learn to dowse for anything they want. You can dowse for water, minerals, or dowse a person to find where their illness is located. Or dowse a map to find where something is. One of the best of this genre is *Vibrations* by Owen Lehto. It's in my *Guide*, along with a source.

Yes, I saw the "Alan Alda *Scientific American* Frontiers" TV show debunking dowsing and other paranormal phenomena. What a crock!

But then dowsing is no more mysterious than the ramifications of quantum mechanics or the structure of the atom, of which do we have little more than theories.

It seems as though every time we try to go beyond where we can see, we come up with theories which are exploded when we extend our vision. Everyone could plainly see that the Sun went around the Earth every day—until the telescope came along. The idea of bacteria was ridiculed until the microscope was invented. Of course scientists refused to look into it, just as they'd refused to look through the telescope.

Prophecy, despite uninformed skeptics, is alive and well—we just don't have a clue as to how or why it works. But we do know that it is a skill that anyone can develop.

Continued on page 79

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

I'm bored!

Ham radio is a wonderful hobby encompassing all kinds of activities, from worldwide voice, CW, RTTY, and SSTV, to VHF/UHF, microwaves, satellites, ATV and even spread-spectrum experimentation. Yet, if you've been a ham for awhile, you will undoubtedly come to a day when you'll look at your rig gathering dust in the corner and think, "I'm bored!" Somehow, the act of saying "five by nine, thanks for the contact" to somebody in Finland just isn't as exciting as it once was. And, with the Internet filling your E-mail needs, not to mention plenty of hours, you may not have fired up your packet TNC in quite awhile. Is ham radio pointless? Are you finished as a ham?

Not by a long shot! Of course, we humans get bored easily—it comes with having big brains. After all, a kitten can spend a lot of happy hours with a ball of string, but how long would it satisfy us? And that's the essential nature of boredom with radio: doing the same thing over and over again. Oh, sure, you've heard it time and time again—get out and try some new facet of the hobby. It sounds good, but sometimes it also sounds expensive or very time-consuming. And you may feel like you don't know enough, or you just may not know where to begin. So, let's take a look at ways to have fun with radio that might just re-pique your interest in hamming.

What's the point?

Somehow, in this "buy it, plug it in, and talk" era, we've gotten the notion that the purpose of ham radio is to talk to each other. Nothing could be further from the truth! Folks, barring a nuclear disaster or a major earthquake, the consumer communications systems in place today far outperform anything you can do with a two-way radio, at least for voice communications. For a start, cell phones are full duplex, allowing you to talk and listen at the same time. Fax machines let you zap a document anywhere you want it, in seconds. Personal computers and the Internet give you high-speed, graphical communications and interactions way beyond any amateur digital communications system yet devised. So, if you're in ham radio just to yak, you'll have fun for awhile and probably make some new friends, but you'll get tired of the whole thing after a few years.

At one time, ham radio provided the only long-distance communications besides the commercial telegraph. In those days, range was limited. That's how the ARRL came into being: as a way to organize stations into nets and pass messages in a reliable, regulated fashion. Obviously that's no longer a relevant use, except perhaps in some grand-scale national emergency. However, with the large-scale, consumer-accessible satellite networks now being planned, even emergencies should be covered by more advanced technology than an HF rig and a dipole, or an HT.

So, if talking isn't really the point of ham radio, just what is? Well, it's still handy for public-service events like parades and marathons, but low-cost VHF services like the family radio service and GMRS can handle that just fine. Besides, running comms for the occasional parade hardly justifies all the legal and spectral infrastructure required to keep amateur radio in place. No, there has to be something else, and there is!

The point of ham radio is *learning*, and it always was, right from the first spark transmission. It was the experimenting and learning of individuals that made radio possible in the first place. In the beginning, *all* radio was amateur. It became a business only after hams made it work. (Our thanks for that was having our spectrum privileges chopped up, and being relegated to frequencies people thought they couldn't use to make money.) Perhaps you figure that, by now, everything that can be known already is, so why bother to reinvent the wheel? True, the basics are very well established, and plenty more beyond that. But everything? Hardly! A lot of today's technology, from cell phones to the use of SSB in military aircraft, came out of advancements either created or refined by amateurs. The game isn't over yet!

So, what's left? Most of the uncharted waters these days are either digital, at extremely high frequencies, or both. Does that mean you need a Ph.D. to make anything new? No way! Heck, I discovered a little thing myself: the self-biasing, linear application of power MOSFET transistors as RF amps, at gains way higher than what's in the books, and with fewer parts, too. Was I inventing some microwave, high-speed digital link? Nope, I was just fooling around with building a little 80-meter transmitter, and I found that the transistor would do something it wasn't supposed to be able to do. Sometimes it's that simple.

OK, not everyone is a technical junkie. Many hams today don't even know how to solder. If you don't, then *learn*. It isn't hard, and it isn't expensive. Even if you never plan to build anything, you'll undoubtedly need to resolder the mike connector on your mobile rig one of these days, because the wire breaks after a few years. I've had to do it to every rig I've ever had for more than a year or two. The point I'm making is that ham radio is not a consumer electronics playtoy, and the shipping box is not your only recourse when things go wrong (although you should use it while the radio is in warranty, of course). It's a technical hobby, it always was, and it should continue to be one! Even if you never get past Ohm's law, you'll have gained way more insight than the average person has, and you can begin to see how things work. Even if you never build anything, at least you'll have begun to see things in a structured, logical fashion. And that can lead to all kinds of insights later on.

Once you can solder, consider building a kit. There are lots of cheap, easy-to-construct kits that will give you a wonderful introduction to electronics, integrated circuits, etc. And, you wind up with a fun gadget! It doesn't have to be a ham radio device, either. One of these days, I'm going to order one of those stereo FM transmitter kits. I'm not sure why ... they just look like fun. And, I'd like to learn a little more about the fine details of how the stereo multiplexing is really done. Why? Because it's interesting! Plus, who knows, it might lead me into some new idea I'd never have thought of without it. Besides, it would just be cool to be able to send stereo program material around the house.

Not only do kits give you hands-on experience with real chips and circuit boards, they often include enough basic theory of operation to give you some insight. If you make a little receiver, you'll probably have to learn how to align it. By doing that, you'll understand what an IF is and what it really does in a way no book or article alone could impart. The next time you see a radio not working right, you may think, "Hmmm, that reminds me a lot of how my kit was before I aligned the IF stages."

Once you've completed a couple of kits, give some

Number 51 on your Feedback card

Hams with Class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Raising student expectations

Now that the school year is well underway, I try to stand back and assess the responses of the students to the ham radio program. As most teachers know, the techniques that worked in an inner city school five or 10 years ago do not have the same effectiveness today. Children are now coming into the classrooms with different backgrounds and a whole new set of needs that are reflective of today's problems in society.

There are times when I think my career as an intermediate school teacher includes as many skills in social work and psychology as it does in pedagogical techniques. As professional educators and instructors we must keep abreast of the latest research and findings in the areas of student motivation and expectations. Keeping this in mind, I recently attended a seminar that addressed these very problems.

Because of the unique nature of what I teach (amateur radio as a tool to motivate in other curriculum areas), I need to keep my students motivated enough not only to do the work, but to keep them interested enough to want to get a ham radio license. A technique I've long recommended in this column is to have a variety of activities going on during the 40-minute period so that the children don't get a chance to become bored. I do 15 minutes of theory, 10 minutes of code practice, and the rest of the time on the radio.

The popular question that got addressed at the seminar was, "Why is it that in a group of children with the same academic ability, some do well in school while others don't?" Marianne Miserandino, a researcher at Beaver College in Glenside, Pennsylvania, suggests that students who are more successful in school tend to believe in their ability to do well and they want to learn more. The children in the study who exhibited those traits reported feeling more curious and participated in, enjoyed, and persisted longer at school tasks, Miserandino says.

In contrast, she adds, "Those children who were uncertain of their ability and motivated by external reasons lost interest in school, didn't partake in as many activities, felt anxious and bored, and suffered a decline in their academic performance."

Why were some of the children's perceptions of their abilities at odds with their test scores? In part, Miserandino believes, it's because they formed

Photo A. The "Wow!" factor shows on the faces of motivated students who enjoy ham activities.

their self-impressions by comparing themselves with peers or teachers' impressions.

"Having ability or potential is not enough to enjoy success in school or in life," says the psychologist. "Talent and potential will be wasted unless children believe they possess ability and have the freedom to use it."

In the ham radio program with 6th, 7th, and 8th graders, I attempt to go in "Pursuit of the *Wow!*" If I can get at least a few

---

thought to making something from scratch. No, I'm not suggesting you become a circuit designer, although I certainly wouldn't discourage that, either. I'm just talking about building something from the schematic in a magazine article. *73* has plenty of them. Also check out some of the general electronics magazines. They often have plans for audio and video gadgets, as well as various other home toys. Now and then, you'll even see something you couldn't buy in the store if you wanted to. Remember, to be commercially available, a device has to be salable to hundreds of thousands of people, or more; nobody can stay in business making products only a few hundred or a few thousand people may want. That doesn't hold true of construction articles, though! Often, they present projects that very few people will actually build. As long as many readers will read and enjoy the articles, and perhaps learn something from them, publishers will publish them.

I recommend that when you're just starting out, you avoid the harder stuff, such as tiny surface-mount gadgets, UHF and microwave, and very complex things like full-featured transceivers. After all, you'd get pretty frustrated trying to play Chopin études without learning your scales first, right? Give yourself a chance to get comfortable with construction techniques before you go for the big stuff. Besides, the thrill of seeing something you built actually work is about the same for the small stuff as it is for the bigger devices, at least at first.

Other ways

OK, so building things is a fun way to learn. What other things make radio interesting? Teaching, for one. Show someone else how it all works. Got kids? Teach them to solder, too! And don't leave the daughters out of the room; electronics is gender-neutral. Of course, be awfully careful when kids and soldering irons get together: the potential for injury is real. I remember dripping molten solder on my leg when I was seven. It really hurt, and the scar took years to heal. Of course, I never soldered while wearing short pants again, but it didn't dissuade me from picking up the iron an hour later, either. Just be careful.

Other fun things to try: build a QRP kit, make a dipole, and take it camping. Most QRP kits are for CW, simply because CW rigs are easier to make. There are some for SSB, though, which means you could do RTTY with a laptop or palmtop computer, too. It may be dull to point the beam at a country and work a station or two from home, but I promise it won't feel that way when you snag one using two watts from the woods! That simple "five by nine" report will feel pretty thrilling. Even if it comes from a neighboring state. And, it may very well come from halfway around the world!

Built or done something cool? Write about it! You don't have to be an established writer to get it published. If you can write clearly, and have something interesting to relate, it's likely to get printed.

Well, there are lots of other fun things to try, but you get the idea. Operating is fun, but it gets old. Explore some of the other facets of radio, learn something, and you'll find yourself enjoying the hobby more than you could ever imagine.

By the way, they don't call me "Kaboom" for nothing. I've had a few radios go "kaboom" in my time, and every one of them was worth it for what I learned! Until next time, 73 de KB1UM.

Number 52 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

On October 4, 1957, the Union of Soviet Socialist Republics launched an artificial satellite called *Sputnik 1* into low Earth orbit. It was basically a metal ball containing two transmitters and some batteries, adorned with sweptback antennas. As a scientific experiment and a propaganda tool, it was the coup of the century. Its effect on the global space community was permanent. The scientific objectives of the mission were to learn how to place a satellite in orbit, to provide data on atmospheric density by calculating orbital lifetime, to test radio and optical tracking methods, to study radio propagation through the atmosphere, and to determine the best methods of internal satellite pressurization.

Soviet space

Like our American space program, the Soviets really got moving with rocket technology shortly after World War II. We had our German scientists and V2 rockets, and they had theirs. But work on new rocket designs was driven by military goals.

The late 1940s were a period of nuclear weapon design and refinement. During the early 1950s, efforts were focused on methods of delivering these weapons to the perceived enemy. Intercontinental ballistic missiles were the desired medium. Research and test launches became common on both the eastern and western fronts.

Sergei Korolev was the team leader behind the R-7 ICBM in the Soviet Union. This launcher was capable of delivering thousand-pound nuclear warheads from Russia to the United States. It was first tested in 1956 and represented a mix of all the space and rocketry knowledge in the Soviet Union at that time.

In its ICBM configuration, the R-7 would become known as the SS-6 (or OTAN) Sapwood, but as a space capsule launcher the name was SL-1. It was simple, utilitarian, modular, and very reliable. Early launches were from a site near the town of Tyuratam, later to become known as the Baikonur Cosmodrome.

Sputnik 1

"Sputnik" is Russian for "traveler," and *Sputnik 1* (also known as PS-1) went into orbit on an SL-1 rocket. The satellite was a polished, pressurized (1.3 atmospheres of nitrogen) aluminum sphere, just two inches shy of two feet in diameter and weighing 183.4 pounds. Over 60 percent of the mass was batteries. The antenna system was four sweptback whips. Two were 7.8 feet long, and the other two were 9.4 feet each.

Sputnik 1 carried two small transmitters that sent CW "beeps" on 20.005 and 40.002 MHz. During the pause time on one transmitter, the other unit was on the air. The repetition of the beeps could be correlated with the onboard temperature. Signals were received for more than three weeks until the batteries gave out.

While launch was on October 4, 1957, the satellite did not reenter the atmosphere until January 3, 1958. The orbit of this first man-made space vehicle was low, but it was still high enough to orbit the Earth over 1,400 times before the effects of atmospheric drag took over. The apogee, or high point of the orbit, was 947 km and the perigee, or low point, was 228 km. The orbital period was 96.17 minutes per orbit. After the successful launch, rocket designer Sergei Korolev was quoted as saying, "It was small, that very first artificial satellite of our old planet, but its insistent signal resounded across the continents and among all their peoples like the realization of humanity's most daring dream."

Sputnik 40 Years

On February 20, 1997, the radio club FR5KJ of the Jules Reydellet College in St. Denis on Réunion Island and the Polytechnic Laboratory of Nalchik Kabardine Balker Republic (Russian Federation) signed an agreement via video conference to commemorate the launch of *Sputnik 1* by building a scale model for launch from the space station *Mir*. L'Aeroclub of France and the Russian Astronomical Federation also participated.

Students at the two schools were tasked with the design and construction of the satellite. The Russian students would build the satellite body while the French students would take care of the electronics.

Work at both schools began in earnest. By July, the group in Russia had shipped the completed space frame to France for final integration. That same month AMSAT-France President Bernard Pidoux F6BVP brought the satellite to the AMSAT-UK Colloquium in England. Between scheduled talks, Bernard demonstrated operation of the satellite in one of the rooms adjacent to the lecture hall.

"*Wow!*" reactions out of the kids, then I know I'm on the right track. Boring, irrelevant lessons will never rate a "*Wow!*" from children. The enthusiastic teacher who assures all students that they will love all that ham radio has to offer, and that it will be fun to learn all the radio "stuff" because it will make them smarter in their other classes at school, has a built-in high motivation to learn.

In my experience, many of the students I see come with preconceived notions that they won't be able to do the right thing on the air. I always stay behind them at the "shack" to offer support and encouragement. I tell them not to worry about running out of things to say, because I'm right there—and I never run out of things to say.

A good example of how high expectations and lots of encouragement really make a difference is what happened in my class last week. One of my 7th graders had been having a really hard time of it in school. He was being tested for all kinds of special programs in an attempt to get him into a more appropriate learning environment for his special learning needs. Chris did very well learning a few letters of Morse code. Of course, I made a big fuss over this and let him work with a little code practice oscillator during his lunch time. In no time at all, he became more proficient at the code than most of his classmates.

Here is a boy who knows he's doing "something wrong" in every other classroom. When he comes to ham radio class he is one of the "stars." There is never a discipline problem in my room with him. Last week he was welcomed into the world of ham radio by hams in St. Maarten, Jamaica, and Puerto Rico on 20 meters. Chris had a smile on his face ear to ear. He felt even more special when I had him tell about his "contacts" to the rest of the class. I really believe that because both the class and I came to "expect" that Chris would always be good in ham radio class, he was good.

There are so many success stories for a teacher lucky enough to be using a ham radio in the classroom. Everyone starts out on equal footing, so students who have never succeeded at anything in school before have a chance for a new beginning. I always think of my dad's words to me when I began teaching many years ago, that "No child ever has to rise to a low expectation." 73

Photo A. Full-size model of Sputnik 1 *that toured the US during the Soviet Space Exhibition in 1991.*

Photo B. RS-17 Spoutnik-40-Ans (Sputnik 40 Years) *on display at the AMSAT-UK Colloquium in July 1997. (WØSL photo)*

The satellite is almost eight inches in diameter, has a shell of polished aluminum, weighs three kilograms, and has sweptback whip antennas.

The system design is very simple. A temperature sensor is attached to an audio oscillator that frequency modulates a 48.6 MHz oscillator. This drives a tripler to get the frequency up to 145.820 MHz in the two-meter band. A pulse oscillator turns the transmitter on and off in a fashion that emulates the beeping signal from the original *Sputnik 1*. An amplifier follows for an output power of 200 mW that is fed to a power divider with phase shifting to create a circularly-polarized signal using the four whip antennas.

Two electronic assemblies and one space frame were sent to the *Mir* space station on board a Progress resupply rocket. Although it was hoped that *Sputnik 40 Years* could be hand-launched from *Mir* on the 40th anniversary of the launch of *Sputnik 1*, delays occurred. The new "*Sputnik Junior*," as some called it, was released by Cosmonaut Pavel Vinogradov while Anatoly Slovyov filmed the event from the Kavant 2 airlock on November 3rd. As it turns out, this was the 40th anniversary of the launch of *Sputnik 2*.

During construction and after launch, the satellite has acquired a few names such as *Spoutnik-40-Ans*, *Sputnik 40 Years*, PS-2, RS-17, and *Sputnik, Jr*. Shortly after launch it was suggested that the satellite be given an OSCAR number. The best suggestion was Sputnik-OSCAR-31.

The resultant transmissions from the commemorative satellite could be heard on mobile radios, HTs, and scanners. Two days after the satellite was released from *Mir*, the Houston AMSAT group got some curious stares while standing in a parking lot in southwest Houston listening to beep sounds on little radios during lunch hour.

Stations interested in the satellite's temperature devised ways to measure the frequency of the beep tone. A tone frequency of 1208 Hz corresponded to 10° Celsius, while 1290 Hz represented 30° Celsius. Enthusiasts and educators found the simple temperature measurement exercise more interesting when results over several days were plotted together showing a gradual decrease in internal temperature. The internal batteries were chosen to provide one to two months of operation. The orbit should last for at least a year.

For those who heard the signals from the satellite, QSL cards and certificates are available. The official QSL manager in Europe is F1FY, but a special certificate is available for reception reports (with an IRC—International Reply Coupon) sent to the FR5KJ Radio Club, 103 Rue de la Republique, 97489 Saint Denis Cedex, Reunion Island, France. All submissions for certificates should be sent in before the end of February.

More history

If you would like to find out more about early space history and *Sputnik 1*, NASA has an excellent series of Web pages beginning at the URL (Universal Resource Locator) [http://www.hq.nasa.gov/office/pao/History/sputnik/index.html]. For additional data about *Sputnik 40 Years*, check out [http://www.oceanes.fr/~fr5fc/angspoutnik.html]. 73

*Photo C. Bernard Pidoux, president of AMSAT-France, with the RS-17/*Spoutnik-40-Ans *at the AMSAT-UK Colloquium. (WØSL photo)*

Let Us Know!

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Send your stuff to Joyce Sawtelle in the Editorial Department, *73 Magazine*, 70 Route 202 N, Peterborough, NH 03458.

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. Part 1 of that series was printed last month; part 2 follows:

Lightning protection: what your mother never told you!—Part 2

In the first part of this series, we gave you some little-known lightning statistics; showed that while we can't control when or where lightning might strike, we can exercise some control over how much damage it will cause; stressed the importance of a single low-impedance ground system; and briefly outlined how such a system can be implemented in your own ham radio installation. Much more detail will be following in the coming months, so stay tuned!

Picking up where we left off and changing gears slightly for a moment, remember that the energy in a lightning bolt covers a broad range of spectrum, from DC on up through the UHF frequencies. We hear lightning strikes in our HF receivers and we see it on our UHF television sets ... it's RF. Whenever we're dealing with RF energy, simple resistance measurements are no longer adequate—system impedance must also be considered. System impedance certainly includes DC resistance, but it also takes into account inductive and capacitive reactances. The higher in frequency we go, the more the system impedance will be determined by these inductive and capacitive reactances. With this in mind, let's continue.

Three techniques to improve conductivity

Every conductor has measurable inductance. Similarly, ground conductors (radials) exhibit normal inductance before they go below grade. Once in conductive ground, most of the inductance of bare conductors and ground rods is also shunted by the Earth's conductivity.

If the soil at the grounding location is not very conductive, several techniques will improve the situation. First, increase the surface area of the conductor to decrease its normal inductance. Second, replace the soil with coke breeze, bentonite clay, or other doped soil to increase its conductivity and help shunt the inductance of the in-ground bare conductors. Third, install additional bare radial runs, with attached ground rods, to effectively parallel the inductance, thereby reducing the overall system inductance. Adding a drip system to keep the soil moist can be effective. In some locations it may be necessary to utilize all of these techniques for the best results.

Conductor surface area

The most effective material for a ground system conductor is bare copper strap. Because lightning has a large portion of its energy in the UHF range, it will behave like an RF signal. Energy (the surge current) will primarily be conducted on the surface of a conductor (the RF "skin effect"). RF currents within a round conductor will not make use of the round conductor's large cross-sectional area because of this "skin effect." The so-called "skin effect" forces RF signals mainly toward the surface of a conductor. With a 1.5 inch (or larger) flat strap (of at least 26 gauge or 0.0159 inches), both of the large flat outside surfaces will be responsible for conducting the surge. So large, flat, bare copper strap is the best choice for your ground radial system.

Soil doping

Water, in its purest form, is an insulator. Ionic salts, mixed with water in the soil, create ionic soil. The Earth is a conductor due to the number of ionic salts naturally present in the soil. So conductivity can be improved by adding more ions to the soil.

Soil doping is accomplished by either adding water or a saline solution to the soil around the grounding system. If the soil already has a sufficient amount of naturally occurring salts, adding water will free the ions in those salts, improving conductivity. The more ions (salts) available, the less water needed to reach a given level of conductivity.

If few natural ions are present, additional salts such as Epsom ($MgSO_4$) or rock salt (NaCl) can be added to the soil to increase its conductivity. Depending on the amount of rainfall, doping the ground system radials with four pounds of salt per 10 linear feet, and 10 pounds per ground rod, can substantially improve the ground's natural conductivity. The length of time that this doping treatment will last will depend upon the rainfall in your area and the percolation factor of your local soil. Note: Adding salt will damage lawns, trees, grasses and other plantings. The addition of salts will also decrease the life of the metals used in the grounding system by corroding them. In addition, you may face pollution charges.

Ground radials

Radials are the most cost-effective grounding technique when considering system impedance, material cost, and labor for installation. If one radial gives "X" resistance, then two will deliver an equivalent "parallel rule" plus about 10 percent. The "parallel rule" is the same familiar formula used for calculating resistors in parallel. The rule only applies, however, when the soil has the same conductivity over the entire radial area. Also note that after the first two radials, we must double the total number of radials each time to achieve the parallel-plus rule.

Radials have an effective length limit. If the surge energy has not been launched into the soil within the first 75 feet, the inductance of the radial will prevent any further effective propagation of the lightning strike. As a general rule of thumb, all radials should be at least 50 feet long, but no longer than 75 feet.

Ground rods should be placed along the entire length of each radial. The most cost-effective spacing between rods for normal (grassy) soil is two times the length of a rod into the ground. For example, if eight-foot rods are used, they should be placed on 16-foot centers (8 x 2). If the soil is not a good conductor (e.g., very dry or sandy), additional ground rods should be used with closer spacing to reduce the natural inductive impedance.

Ground measurement

Since most soils are stratified, the best way to determine the effectiveness of a ground system is to measure it ... at various depths. The simplest way to determine the sub-layer conductivity is to measure the first ground rod, one foot at a time, compared to a reference ground rod, using an earth resistance meter, as the new rod is hammered into place. This technique can provide a profile of the lower layers relative to the first foot. Most earth resistance meters measure only DC or low frequency AC resistance of the ground system. Since the fast rise time of lightning strike energy is predominately RF energy, the inductance of the ground system is important. Without using expensive specialized test methods, the

only way to ensure a low-impedance ground system is to follow the suggestions previously presented for conductors, doping, and radials.

That's all from Roger and Ron Block for this month. Be sure to check back next month for more of their advice on keeping your ham station reasonably safe from the devastating effects of a lightning strike ... their series will continue in this column throughout the rest of 1998. You can also read the entire text immediately, by calling up the special bulletin "Protection to Keep You Communicating," at PolyPhaser's home page on the World Wide Web at: [http://www.polyphaser.com/].

And now, a few updates to some past Ham To Ham columns ...

The mysterious capacitor ... update

From Wray Lemke KI4XS: a note regarding the piece in the August 1997 "Ham To Ham" column by Ken Guge K9KPM, and his experiences with and warning about the dangers of humid air being trapped inside the connecting block of an antenna. Ken's conclusions were right on the money! "I read the piece from Ken K9KPM and thought I'd offer our experiences in the marine electronics field. Here's what we've found: Take an object with a volume of air inside, such as a ship's radar dome or some air dielectric coax. Now heat it up in the July sun, then rain on it and cool it off rapidly. The air inside the object will decrease in volume creating a considerable vacuum which can suck in an amazing amount of water ... right past gaskets and other forms of weather sealant schemes. The solution (as Ken suggested) is to either make the open interior space truly airtight, or to leave a vent hole so that the air pressure can equalize during rapid temperature changes."

Moderator's note: K9KPM originally suggested filling the void in a connector or connecting block with an RF inert material, to keep humid air out by simply not providing any room for it! Still a wonderfully simple solution.

More power to you ... update

From Ariel Elam K4AAL: "In the October 1997 'Ham To Ham' column, Stephen Reynolds NØPOU offered a tip on using an abandoned electric range 240-volt breaker as a potential source for a dedicated power feed into the ham shack: '... when our electric stove finally gave up ... we decided to replace it with a gas unit instead. I now had a 240 volt, 40 amp circuit on my current fuse panel that was available for other usage, namely my ham station! I ran #8 gauge wires to a new sub-panel in my shack, being careful to follow all of the electrical codes for my area, and I now have plenty of power conveniently available for just about anything imaginable, of either a 240 volt or 120 volt nature' (quoted from Stephen's original tip).

"Stephen's idea is a good one, but if the rated capacity of your main breaker panel isn't now at full capacity (ampere-wise), you may not have to wait until a major appliance is replaced to provide a separate feed to your ham shack. Lots of folks don't realize that most service panel manufacturers now make 'tandem' or 'twin,' half-size circuit breakers these days. The half-size breakers are two individual circuit breakers built into one standard-size breaker case. As a result, two tandem circuit breakers may be used to replace two full-size breakers, freeing up two spaces for a two-pole breaker that can then be used to feed a 240-volt ham shack sub-panel. Again, as Stephen suggested, make sure that your service panel is rated for the extra current that may be needed (particularly if you're adding a husky linear amp), and be familiar with and always follow your own local electrical codes to the

letter. Seek out the help of a licensed electrician if you don't know the electrical codes, don't have the experience needed to work with high-current AC, or don't have the means to do-it-yourself."

Moderator's note: Thanks for the information, Ariel. I wasn't aware of the half-size breakers myself. Even if you need to hire a licensed electrician to do the job, just knowing that the whole service box may not need replacing makes the task of a separate service feed for the shack seem a less daunting project.

Recycled tubing ... update

From Jon Seaver N8SUA: This timely warning: "With reference to Bob Boehm NBEXF's contributions presented in the May 1997 'Ham To Ham' column, as a practicing paramedic and ER nurse, I'd like to share a few concerns. While there may be some practical ham radio uses for discarded medical tubing, etc., there also is some potential for danger in recycling what is essentially medical waste. This is, after all, the 'Age of Universal Precautions.'

"'Universal Precautions,' for those of you who are not in the sick-people business, refers to the procedures taken by health care workers to protect themselves from acquiring blood-borne disease-causing agents. The highest profile among these is the agent causing AIDS, the Human Immunodeficiency Virus or HIV. We should always act as if any fluid originating from the human body is teeming with your least-favorite germ or virus. Never allow contact between your skin and any potentially infectious material. If you don't think that you have any cuts or scrapes on your hands by which germs can enter, simply immerse them in alcohol for a few seconds. That stinging pain identifies all the little portals of entry which could be utilized by whatever germ you might encounter.

"So before you undertake to recycle medical waste, consider that you might be exposing yourself and, worse yet, your family, to a variety of undesirable organisms. Among the agents you may not want to invite into your home is a species of Staph Aureus (which is resistant to every antibiotic currently available). Another is known to physicians and nurses as "VRE," for Vancomycin Resistant Enterococcus, which is also immune to nearly everything we have to throw at it. Is the utility of that piece of tubing worth the risk?

"On the other hand, perhaps you may have access to supplies that are being discarded, simply because they're outdated and not considered fit for use on human patients. These should pose no undue risk, but make sure that you know what you're getting before you grab!

"Examples of potentially useful items are *unused* plastic bags containing IV solutions. Drained of their contents, they might be used for fashioning a rain-guard for your handheld transceiver. I've cut off the end that contains the port for inserting the tubing, and then carefully made a small slit for the BNC connector of an HT to poke through. Another potentially useful item is the foil overwrap sometimes found on bags of premixed IV solutions, or used to package "splint rolls" of plaster or Fiberglas™ casting material. These might provide some protection against the dreaded Electro-Magnetic Pulse or could also find use as an antenna attenuator for near-field foxhunting.

"But please, don't recycle anything if you have any doubts whatsoever about its exposure to disease-causing organisms—it just isn't worth the risk."

Moderator's note: Jon brings up a very valid point with regard to attempting to reuse discarded medical supplies that come from unknown sources, and of unknown infectious state. In the May 1997 column, however, both Bob Boehm and I were referring to medical tubing that came from our own hospital experiences, and therefore of intimately familiar origin. I would hope that no one would ever attempt to scrounge such tubing from any other source, so it's worth noting the dangers Jon mentions.

Hex on them!

From time to time, original equipment manufacturers seem to put extra effort into thwarting the do-it-yourself product servicer from gaining entry into his own equipment ... for whatever reason. The oddball assembly screw is one of their favorite means! I recently ran into one such effort used by a manufacturer of computer power supplies. They used assembly screws that appeared to be of the Torx™ variety (six-pointed star), yet an ordinary Torx driver wouldn't fit them. Upon careful examination (dragging out my trusty magnifying glass!), the reason became clear ... the star-shaped recess of the screws also contained a small male center pin! See **Fig. 1**. Apparently the Torx driver that the manufacturer uses to assemble the unit has a hollow shank, whereas most consumer Torx drivers have solid shanks ... so of course they won't fit.

Not about be outsmarted, I found that I was able to insert a small, straight-bladed screwdriver into the Torx recess, immediately next to the center pin (see **Fig. 2**), and snap off the pin with a quick, calculated blow from a small hammer. A bit more primitive than I prefer to be when trying to open up a piece of equipment, but it worked. I was then able to remove the screws with my standard Torx bits. Just an idea to keep in mind if you happen to run into the same situation. By the way, there was also no way to "grab" the sides of the truss-head-shaped screw with locking-grip pliers, another technique that sometimes works for oddball screws. A "hex" on manufacturers who get cute with their hardware!—de NZ9E.

Murphy's Corollary: A lost piece is always found in the last place you'd think of looking ... so next time, it might pay to look there first!

Many thanks, as always, to this month's contributors:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Wray Lemke KI4XS
Box 688
Sullivans Island SC 29482-0688

Ariel M. Elam K4AAL
1065 Barnes Road
Antioch TN 37013

Jon Seaver N8SUA
RN BSN EMT-Paramedic
P.O. Box 278
Rapid City MI 49676

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special

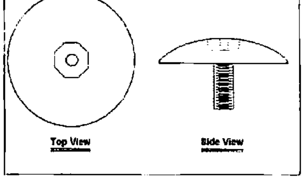


Fig. 1. One version of an assembly screw used by some equipment manufacturers apparently to thwart the efforts of equipment owners to do their own servicing.

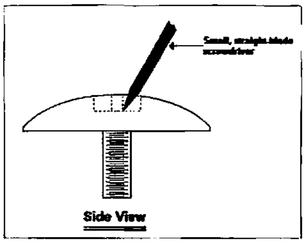


Fig. 2. NZ9E's answer was to chisel off the offending center pin with a small screwdriver.

QRP

Low Power Operation

Mike Bryce WB8VGE
SunLight Energy Systems
955 Manchester Avenue SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Last month, we began by repairing a broken VFO capacitor in the Heathkit HW-8 transceiver. Since the HW-8 is a direct conversion rig, the operation of the VFO is paramount! But don't get me wrong: A dead VFO makes for a dead superhet transceiver just as well.

Because most of the gain in the receiver is done at audio levels, a fingertip is by far the best signal injector made for a direct conversion receiver! I'll have some receiver repair tips next month, but for now, we'll look at fixing an HW-8 with a dead transmit band or two.

Dead band on a working radio

For right now, I'll assume you have an HW-8 with a working VFO. Use your frequency counter to verify that the VFO is in fact working and on the correct frequency. The VFO inside your HW-8 should operate between 8.645 MHz and 8.895 MHz. Lightly couple an accurate frequency counter to the emitter of Q3, the emitter follower for the VFO. As in last month's column, don't get upset if the VFO is not 100 percent right on frequency. Just be sure it's running and between 8.645 MHz and 8.895 MHz.

One very common problem with the HW-8 is having one or more bands that are kaput! It's not at all uncommon to find 80, 40, and 15 meters working correctly, but the 20-meter band dead. Sometimes the rig will transmit on 20 and not receive or perhaps the other way around. There are two avenues to take. We'll look at the dead transmit side of 20 meters first. Remember, although I'll use the 20-meter band as an example, the troubleshooting guide and fix apply to any of the HW-8 frequency bands.

No receive

Perhaps the best place to start is the receiver. In the HW-8, each band has its own frequency-dependent components. When the operator selects a particular band, by pushing in the corresponding button, 12 volts is routed to a switching diode. In this way, only one transistor in the RF amplifier is required to cover all the frequencies covered by the HW-8. This not only reduces circuit complexity, but lowers assembly costs as well. Can you just imagine what a mess it would be inside an HW-8 if there were a multi-layered rotary switch instead of the push-buttons?

By applying 12 volts to a selected diode, the diode conducts, and in effect turns the tuned circuits "on." This is known as diode switching. The Heathkit Company was really into diode switching, as most of their ham gear used some form of it. I'll bet money Heathkit bought 1N914 diodes by the trainload!

In the HW-8, with the 80-meter band button in, diodes D1 and D5 are turned on. Diode D1 conducts and places C1, C3, and the preselector C301A in circuit. This combination feeds the gate of the receiver front-end amplifier, Q1. At the same time, diode D5 conducts and places inductor L5, C15, and C16 in the drain lead of Q2. By using only two diodes, we have selected over a half dozen tuned circuits.

Since each band has its own tuned circuits, finding the cause of a particular dead band is not that difficult. If you have one dead band, but the other works, bet the farm it's a switching diode. I've had a case or two of a diode becoming leaky. This causes an overall reduction of sensitivity to the rig.

It's somewhat rare, but be sure the switching diodes are being fed the proper voltage from the band switches. I've found in two cases that the +12 volt feed wire had broken off on the switch terminal. Usually, this is caused by flexing the wiring harness or from a nicked wire during assembly. The diodes must see +12 volts to be biased on.

Instead of checking the diodes, I've found it best to replace the suspect ones. Remember that

---

thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of 73, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator nor 73 for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas you have to NZ9E at the address at the beginning of the column. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions on any particular tip to the originator of the idea, not to NZ9E nor to *73 Magazine*. Thank you ...

Number 52 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

"*Radiogoniometrie Sportive*" in Montreal

I love visiting new places. Sure, I can have instantaneous communications with people in the far corners of the world via ham radio, when band conditions permit. But to me, there's nothing like viewing firsthand a mountain sunset, an immense cathedral, or a rare bird species.

Ham radio adds to the enjoyment of any vacation, whether or not you take any radio gear with you. Traveling with hams and meeting them in places you visit means instant friends and added adventures. With hidden transmitter hunting (T-hunting) becoming more popular in cities and towns all over the world, it's not too difficult for me to find fellow radio direction finding (RDF) enthusiasts wherever I go.

Canadian capers

Despite having months of freezing weather every year, hams in Montreal, Quebec, have done mobile T-hunting for quite a while. Long-time "Homing In" readers may remember the story of a snowy Montreal T-hunt in the January 1994 installment. I wrote at the time that I wanted to go T-hunting there on my next visit.

In July 1997, I received an E-mail from Jacques Brodeur VE2EMM, telling about Montreal's mobile T-hunting, or "*radiogoniometrie sportive*" as they call it (**Photo A**). He was also excited about his club's RDF equipment projects based on 8-bit PICmicro™ microcontrollers by Microchip Technology, Incorporated, commonly called PICs. Realizing that April WA6OPS and I would have a free Saturday in Montreal in October, I replied to Jacques and asked if there would be a T-hunt on that day. He promptly replied that they would schedule one just for the occasion!

To say that the T-hunters of Montreal rolled out the red carpet for us would be quite an understatement.

For twelve hours, we were chauffeured, fed, and entertained by some of the most hospitable hams we have ever met. Of course, the highlight for me was the T-hunt, a regular activity of Union Metropolitaine des Sans-Filistes, the largest French-speaking amateur radio club in the world.

The day was quite cool, but fortunately there was no snow. (It waited until the day after we left.) Nine teams gathered at Pointe Aux Trembles for the 2 p.m. start. Claude Houde VA2HDD explained the rules: 20 mile radius boundary, first team to find the transmitter wins, take a numbered tag when you find it.

Other than nearby Mount Royal, the hunt area is relatively flat. There are very few hills, tall buildings, or other good reflectors of VHF signals. Doppler RDF sets perform best in this type of terrain, so such gear is quite popular with the Montreal hunters (**Photos B** and **C**). All but one team's vehicle had one on board. Most of them were home-built.

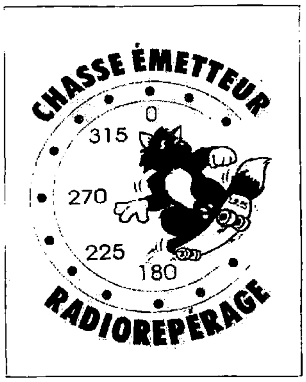


***Photo A.** Montreal RDF enthusiasts proudly wear T-shirts with this logo. UMS stands for Union Metropolitaine des Sans-Filistes.*

One drawback of two-meter Doppler installations is that they have less sensitivity than amplitude-based setups that use the receiver's S-meter, an RF attenuator, and a beam or quad directional antenna (**Photo D**). Sure enough, the hider's signal was very weak at the starting

---

you should replace both diodes in the suspect band. The diodes used for the receiver are D1, D2, D3, D4, D5, D6, D7, and D8. The mixer amplifier uses diodes D16, D17, D18, and D19. If one of these diodes is out, both receive and transmit for a particular band will be affected. The mixer amplifier, Q4, must have the proper tuned circuit active before the HW-8 will operate.

While we've been focused on the receive end, the same applies to the transmit side of the HW-8. Diode switching is used to turn on the various tuned circuits for the transmitter as well. Diodes D31 through D37 select the proper tuned circuits for the transmit driver, Q8.

The heterodyne oscillator, Q6, requires that the proper crystal be inserted into its circuit. Diodes D22 through D29 accomplish this feat.

The heterodyne oscillator requires some more attention. Here, the diodes switch various crystals into Q6's circuit. With the HW-8 now around 20 years old, there's a good chance that one or more crystals is either not working or way off frequency. Here again, one or more bands may appear dead.

To check the heterodyne oscillator for proper operation, very lightly couple a frequency counter to the base of Q7. With the 80-meter band button pressed in, the counter should read 12.395 MHz. Check each band for proper operation by selecting the band (push in the corresponding button) and noting the frequency on the counter. Here's what you're looking for: 80 meters—12.395 MHz; 40 meters—15.895 MHz; 20 meters—22.895 MHz; 15 meters—29.895 MHz.

So, here's what you should look at if you have a working HW-8 with a dead band.

If the receiver is dead on a single band, check for proper +12 volts from the push-buttons to the switching diodes. Check for proper operation of the mixer amplifier, Q4 and Q5. Replace diodes on suspect band.

If both the receiver and transmitter are dead, do the above and also check heterodyne oscillator Q6 and Q7. Check for proper frequency of the heterodyne crystals.

It's rare, but a broken wire on switch sections "F" and "D" will cause a "dead transmit" problem. These sections switch the tuned circuits in and out of the collector of the final RF power transistor, Q9. There are no diode switches used here. Pay particular attention to the center conductor of the sub-mini coax going to the push-button switches. A wire nick during assembly 20 years ago may cause the wire to break today.

Wire breaks on the center conductor of the coax going to and from the "RF GAIN" control will give you a dead receiver, but a working transmitter. Also check to see if the coax center conductor has broken off as it enters the circuit board beside the T/R relay.

That's about all this month. Next time, we'll look at some of the receiver problems that plague the HW-8. We will also look at some of the all-time favorite modifications to the HW-8 QRP transceiver.

Photo B. Louis Tremblay VA2JX and daughter Viviane won the hunt using this mobile 32-LED Doppler setup. He also uses a GPS unit.

Photo D. This team has an elaborate rooftop mount for the two-meter mobile RDF quad, with a surplus radio-compass inside to indicate direction.

point, so all the hunters hauled out the beams and quads they keep on hand for such situations (**Photo E**).

Because mileage traveled is not considered when determining the order of finish in this club's T-hunts, something special is needed to keep them from becoming road races. The one- to two-mile-wide St. Lawrence River serves this purpose well. Running south to north through the boundaries not far from the starting point, it presents a partial barrier with only a limited number of places to cross. The river and the islands in it can affect signal propagation, too.

Jacques and I were a two-person team on this Saturday, his first T-hunt in his new van. I played navigator, the word "played" being important because I was completely unfamiliar with the territory and thus totally unqualified for the job. The starting bearing was generally to the southeast and the weak signal led us to believe that the fox would be found near the hunt boundary. After drawing the bearing line on the map, we decided to take the main road south for seven miles to the first bridge in that direction where we could go east across the river. This would be the fastest way to get to a fox near the boundary along our line of bearing.

Photo C. VA2JX and his rooftop-mounted Doppler antenna set.

Where's the signal?

Jacques' Doppler displayed weak signal bearings as we left the starting point. After about a mile, the signal faded out. We continued to follow our game plan, but the signal was still not copyable after we crossed the river. Unless the hider was using a very sharp beam pointed at Pointe Aux Trembles, we should be getting a much stronger signal here. Perhaps the fox was much closer to the starting point.

We decided to go north again via a road on the east side of the river. Sure enough, the signal came up as we began to approach the original bearing line. Doppler indications were erratic, so on two occasions we stopped, got out and used the quad to try to get a more precise bearing. As we arrived at the bearing line on our map, it appeared that the signal source might be in the river, on one of

Photo E. Ron Racine VE2ESX needed this yagi antenna to get a bearing at the start point.

Photo F. The hidden T's copper pipe J-antenna was nearly concealed in a tree.

the islands, or perhaps back on the starting side.

Oh, no! Had the hider pulled a fast one on us? I told Jacques of several occasions when southern Californians had put micropower Ts only a few hundred yards from the starting point, placed so that the hunters did not pass by as they departed the hilltop. When the signal disappeared, most of them just thought this was the normal result of lower elevation. They traveled for dozens of miles before realizing they had been snookered. Could this be happening to us?

Photo G. When Rene Camirand VE2ND gets out to hunt on foot, he uses a ZL Special antenna made from twinlead mounted on a PVC pipe frame. Plans for this antenna are in the book Transmitter Hunting—Radio Direction Finding Simplified, *available from 73's Radio Bookshop.*

Jacques and I kept going, trying to get enough additional bearings from different locations for triangulation to determine which side of the river VA2HDD's T was on. He assured me that the fox could not possibly be on one of the islands, because it would take a boat to get there. As we came to the little town of Varennes, the signal suddenly rose from the noise. Perhaps we were finally closing in.

We soon ended up in a church parking lot across the street from a shoreline green belt with "you are here" signal levels. This was only about two air miles across the river from the starting point. Jacques handed me a two-element beam made from the snap-out elements of a TV antenna. An offset attenuator (plans in the *ARRL Handbook*) was in a box fastened to the boom. I hooked it to my handie-talkie. Jacques grabbed a similar beam for himself, and off we went on foot.

The rest was easy. Despite being well concealed inside a small evergreen tree (**Photo F**), the transmitting J antenna was not hard to track down. No doubt the very low power fox signal was weakened further by the antenna's contact with the tree. Our strange bearings on the eastern shore were probably caused by the "river effect." T-hunters in many places have noticed this phenomenon, whereby a river or canyon acts as a waveguide to funnel nearby radio signals. False bearings from up and down river are common under these conditions.

We finished in fourth place. "Not outstanding, but honorable," says Jacques. Besides, the end of the T-hunt was just the beginning of our fun. Rapid-fire conversations in the parking lot continued as we compared notes on Doppler and ZL Special antennas (**Photo G**). There was also plenty of discussion about rules and techniques for T-hunts. Before long, every team had arrived.

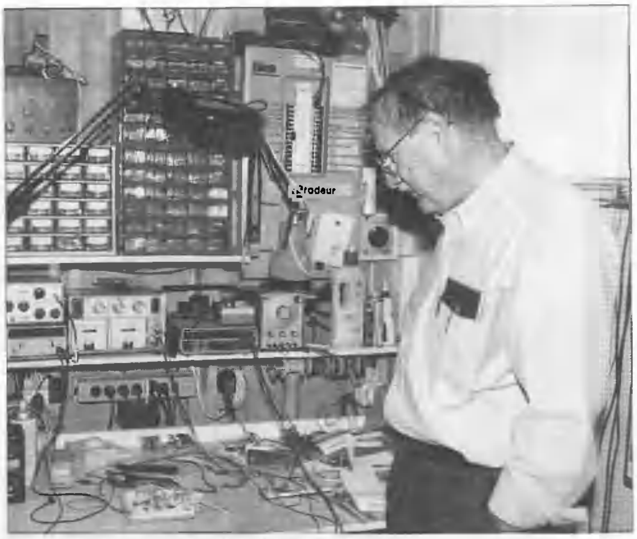


Photo H. Jacques Brodeur VE2EMM looks over a new PIC project on his workbench.

As the sun set, thirty members of Union Metropolitaine des Sans-Filistes headed for a local tavern for good food and more talk. François Tremblay VE2JX had prepared certificates for all the hunt participants and wanted me to pass them out. I'm sure they enjoyed my valiant attempts to pronounce all the French names. April knows a little French, but fortunately, it wasn't needed. Almost everyone spoke fluent English and they even seemed to understand me when I forgot to slow down as I spoke.

PIC projects

Many RDF enthusiasts are home builders, but the ones in Montreal seem far above average. Apparently the long Quebec winters are conducive to basement experimenting. Last winter, Jacques taught a 10-session workshop on microcontroller hardware and firmware for 10 members of the club (**Photo H**). Then they all went forth to dream up ham radio uses for PICs.

Francois Tremblay VE2JX (twin brother of hunt winner VA2JX) is a firefighter who works long shifts. Fortunately, he hasn't had too many fires to fight, so he had time to design a multifunction fox controller with potential uses in both mobile T-hunts and international-style radio-orienteering.

Jacques decided to experiment with PICs as a way to simplify the construction of Doppler RDF sets and to add functions. His first attempts at signal processing didn't work well, but he kept trying and now has a functional unit that worked just fine when I hunted with him. I hope to feature Montreal's PIC projects in future "Homing In" columns. Watch for them.

The Montreal experimenters have a Web site, of course. You can link to it, as well as to local RDF-related Web sites and "Homing In" correspondents in more than 73 other locations around the world by browsing the "Homing In" site. The URL is at the beginning of this article.

If T-hunting in the February snow isn't for you, head to Orlando for the 1998 Hamcation convention. Tim Starr AE4NJ invites "Homing In" readers to the Hamcation mobile T-hunt on

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

A roll-your-own HF modem for $15: RTTY, AMTOR, and SSTV to fit your budget

You may wonder if any of the kits for sale or projects you read about are worth the hassle to put together or whether it is simply better just to purchase a ready-made unit and plug it in. After all, I did it. I have to admit I learned a lot from some new experiences with that little modem I have written about during the last few months. Things never quite worked like the book said, but they *worked* and afforded a form of success.

A death in the shack

After a long period of bug chasing, my little multimode modem bit the dust. The manufacturer said he would check it over and repair it if necessary. It would only cost $40, about half of what I spent in the first place. The problem with the modem is obvious. There is a bubble on one of the transistors.

I am not up to speed in replacing surface-mount components and the idea of parting with repair bucks made the top of my wallet suck shut. I told the service tech on the telephone that there were alternatives. For instance, there was a schematic included with the documentation for one of the programs furnished with the little rascal.

He said to go right ahead and try assembling one of the units from information available, that was my choice. I hung up the phone with a smile like a cat whose mouse had just run into a puddle of honey. Life just isn't complete unless I can prove something, even if it is only to myself.

Something new (and cheap)

I recalled seeing an enticing Web site with a schematic and a parts list. I bookmarked it in my Netscape. It is "K7SZL's Unofficial HamComm Home Page" [www.accessone.com/~mayhan/]. I revisited it with increased interest. I printed the schematic plus the parts list, whizzed on down to the local Radio Shack™ store, and purchased enough parts to lay out the board without connectors. I wanted to scope out the cable needs first. Anyway, I had spent a total of $8.75 and this included some duplicates in the packaging. Not bad so far.

I spent about an hour laying out parts on a little all-purpose board and started assembly. I am not a bona fide production-caliber radio tech and it went a little slow, but it went. Before the end, I managed to work myself into a corner a few times. The main thing that would improve the layout would be to make two more of these.

The good part about this is you are working with all audio circuitry. Length of leads is not critical and neither is positioning of components. My eyesight is getting such that I must use a magnifying glass to check the solder joints, but by exercising due care, all went well.

When it got down to choosing cable connectors, the recommended female 25-pin connector matched the cables I have to the computers. The cables I had made recently to the radios all had telephone RJ12 connectors on them. Another trip to Radio Shack for one each of these connectors. Another $6.

You can see in **Photo A** that the leads are a little long, as I was leaving room for revisions—especially at enclosure time. The little circuit board measures a little under two inches by three inches.

The test

It was now time to plug it in and watch it play. The connection to the desktop computer didn't have many choices—simply use the cable that fit. The other end to the radio did offer choices. The easiest option was to use the cable that was made up to fit the mike connector on the front of the ICOM 735.

it receives

I tuned around 14,285 and heard several RTTY signals. With the HamComm 3.1 software up and running, I tuned to the strongest signal and, hard to believe, there were intelligible words flowing across the monitor screen!

Will it transmit?

Now came the acid test. Suddenly, I couldn't recall the key combination to change over to transmit. A little awkward, but I pulled down one of the menus and found that all that was necessary to make the change either way was to pull down that menu and hit Enter. Okay, now what? I found that if I typed, then hit Enter, it would key the transmitter and send what was typed.

Fabulous—the old commercial modem had never cooperated like that. I waited until Fritz W7EPY

St. Valentine's Day, starting at 5 p.m. He says there will be at least one transmitter to find in a public place away from the convention grounds, and he promises a "big prize." For more information on this event, send an E-mail directly to Tim [ae4nj@aol.com].

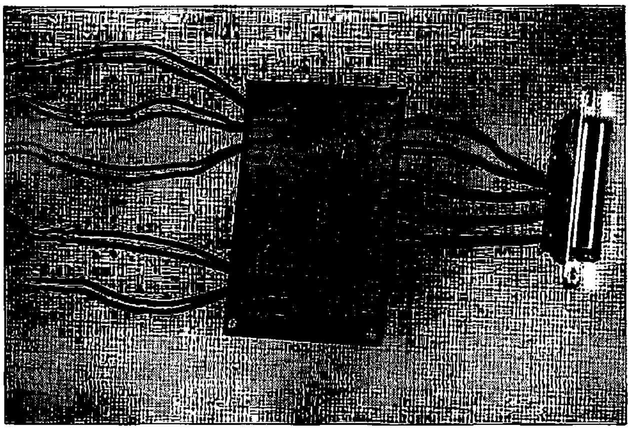


Photo A. Here is KB7NO's serial modem as it was plugged in for the first RTTY QSO. The extra wire is a redundant ground in the event a separate audio feed was needed. Layout is not critical since it is audio circuitry, but it could stand to be a lot neater. The RS utility board number is 276-150; this board appeared to offer the best chance for a minimum of jumpers. The long leads to the jacks were intended to make experimenting simple. But there was no experimenting!

called CQ and gave him a shout. He came right back. I had made the first contact with the project within ten minutes of plugging it in. I didn't think until later that Fritz had told me he was running 300 watts. I hadn't even turned on the amplifier which is often needed on that mode under current conditions, so this was a good test.

Anything that works first try is a truly great experience. For a few dollars I had assembled a serial modem to replace the relatively expensive failed commercial modem and it worked better than the other had when new. There was one drawback. This modem will not work with VHF packet.

I sent E-mail to Terry K7SZL and thanked him for the use of his schematic to enhance the pleasures of my shack. I asked if he knew of a schematic for a modem for VHF packet. He replied and we exchanged messages for a few days.

The makings of a new project

I did find the schematic in question. I thought I had seen one on a BayCom-related Web page, but that site wasn't responding. I checked every packet link I could find for a couple of hours with no success. Then I tried something just too simple. I ran a search for "baycom schematic." Up popped only one site, and it was the right one! It is [www.industry.net/c/mn/_swpacket].

This site contains a self-extracting file that becomes a text file and a schematic. This is great, except that the schematic requires the CompuShow viewer from CompuServe to view and print it. I brought the image up in an old crippled DOS version of that program and I could see it was intact.

So, I downloaded the latest version from CompuServe and I now have a print labeled "BayCom schematic." It resembles a blueprint which I call a "blackprint" (reversed black and white) and would not copy well on my copier, but I saved it as a .TIF file so it is more easily transported. I sent a copy off to Terry because he had not seen one either and was curious about the innards.

I will see if I can have a measure of success with that circuitry. If I do, I will consider mounting both boards in one enclosure if that is feasible. That is a decision to come. The first order of the day is to get a project going and up and running.

Freebies

Last month I mentioned a source for packet through a soundcard. I am quite a way from having this up and running, but here are the developments.

Some very interesting and informative E-mail arrived from Paulo CT1DTA, who is using the PCFlexNet approach to packet radio with a serial modem. After experiencing Paulo's enthusiasm, I took another look at the site: [http://dt10td.afthd.th-darmstadt.de/~flexnet/index.html]. It is still complex, but there is hope. This site, among other things, contains an intriguing approach to doing packet through the soundboard of your computer with no modem or TNC. And did I mention that the programs are free, with not even a shareware fee involved?

In addition to the above page, there is a site by Tom Sailer HB9JNX/AE4WA linked to it which evidences a large amount of work dedicated to making this project manageable for the average ham. This is at [www.ife.ee.ethz.ch/~sailer/pcf/pcfindex.html]. From there you are directed to download areas for the necessary modules.

There was a little education involved as I determined which of the modules was the most important for me. They say you need the FLEXNET.EXE for anything you do with this system. That is found in a compressed file, PCF.LZH, whose location required a careful search.

Forced to get smarter

The fun part, and real education for the day after downloading PCF.LZH, came when it was time to more fully appreciate what the LZH extender represented. It is associated with the LHA program (new to me), which is necessary if you are to use the file. This made me read the documentation for the Windows 95© zip program (which can be downloaded from a myriad of sites).

The documentation clearly states you must acquire LHA213.EXE and install it on the hard drive, open a window in the zip program and type in the path to the LHA program. The procedure is described in detail and went flawlessly after I found a copy of the LHA program on CompuServe. I didn't look, but I am sure it is available elsewhere. When you find it, you will be pleased to know it is free.

In the end, the PCF.LZH archive contains eight files, including a piece of documentation which starts with four pages in German, then (whew!) a translation into English. The all important FLEXNET.EXE file is among the eight.

I also downloaded two other recommended files. In the end, there is the promise that amateur packet can be run without a TNC or modem—just with the software and the soundboard. Plus there is a module to allow this to run under Windows 95. That will be interesting to see.

In reading the documentation thus far, it would appear this may not be a simple matter of bringing up a Windows© program while working with other applications. The instructions indicate that the DOS modules must be in place and they may not allow other programs to be up and running. Such is the life of the experimenter. As long as it doesn't cause smoke in the shack, I will go for it to see it work.

If you have questions or comments about this column, please E-mail me at [jheller@sierra.net] and/or CompuServe [72130.1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

Number 63 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Frequency reference oscillator stability tips

This month I want to cover a circuit that can be incorporated into your station's test equipment for either improved timebase accuracy or as a marker harmonic generator for general testing. It can also be used in conjunction with frequency counters which have external timebase inputs to improve operation. If the frequency counter does not have an external input for the timebase oscillator, the circuit can be used to measure and correct the internal oscillator adjustment to proper operation.

With the construction of a simple TTL frequency divider, other marker frequencies can be obtained, depending on the innovation of the constructor and his needs. Stability is an important issue, and there are a few things you can do to either assemble a reasonably good unit or improve the operation of an existing one.

First, let's get into what makes a unit unstable, or the flip side for one that moves in frequency and does not stay put. The simplest circuit that can be constructed is a basic crystal oscillator. It is composed of a transistor or TTL gates and a few resistors and capacitors, along with a crystal. This circuit is usually constructed on top of a circuit board and powered by a battery or low-voltage power supply.

There are several problems with this type of circuit and several benefits. On the plus side, it's small, functions reasonably well, and oscillates somewhere near the crystal-marked frequency. On the negative side, as it is a simple basic circuit, it will drift in frequency about the marked one due to voltage, temperature, and the loading effects on the oscillator (depending on what you connect the device to). Loading can be looked at as the same as using some of the oscillator's power in the output. When you affect the oscillator in any way, the circuit changes ever so slightly and the frequency of the crystal becomes affected by the power being used in the load. Multistage oscillators reduce this loading effect by drawing very lightly on the oscillator and then amplifying the signal.

There are several other considerations to be taken into account, including capacitive loading and leakage from the main oscillator to the output without going through the intended circuit. This leakage occurs when oscillator energy jumps over circuitry through stray coupling paths between the actual oscillator and the third stage of such a circuit. In this jumping over there is coupling between the first stage and the third, with minimal going through the second stage.

It would be like having 1 MHz energy being coupled into the output of a divide-by-10 circuit. In this case, there would be both 100 kHz and 1 MHz present on the output. You can see what I am getting at: signals going around circuitry and re-combining in the output.

How, then, do you design a good oscillator, and what are the properties that make an oscillator great? Looking at some very high accuracy frequency standards, we might not be able to duplicate their excellent construction and circuitry details, but we can adapt several of these features into a good facsimile.

Attributes of a good frequency standard include very tight voltage regulation and low AC ripple (hum and noise) on the DC component used to power the oscillator. A stable temperature environment for the crystal oscillator and associated oven temperature control circuits are also needed. To improve temperature stability, there are usually two ovens. One is a slow time-constant oven directly affecting the crystal oscillator. The second heater is a faster time-constant oven wound over the first one to help stabilize the environment of the assembly.

The inner oven might have a temperature cycle that takes a day of operation before it is able to hold a temperature to a very small range. The outer oven might only take a few hours to achieve this same or nearly same temperature stability. All this is going on to hold the crystal to a single exact temperature and prevent it from being affected by outside effects such as the garage door opening or drafts.

To protect this assembly from drafts and other small temperature effects, the inner and outer

Continued on page 70

Number 64 on your Feedback card

Ham Radio Fun

Letter from Down East

... where at least one ham won't clam up.

Dr. Harold I. Goodman W3UWH
7 Perkins Road
Eastport ME 04631

There you are running anywhere from 100 to 1,000 watts. The ham at the other end is receiving you 5-9-9 plus. You, on the other hand, are receiving him/her at about 3-3-9. You've got your gain cranked open almost all the way, straining to pick up as much as you can of the signal. He/she on the other hand has "armchair" copy.

Second scenario: You are running anywhere from 100 to 1,000 watts. The ham at the other end is receiving you 5-9 plus 20. You, on the other hand, are receiving him/her at about 2-2. You have your gain cranked open almost all the way and have just asked, for the tenth time, "Please repeat your suffix." He/she on the other hand has "crystal clear broadcast-quality" reception.

What's going on? Why, it's QRP, of course. Ten minutes later, he/she is congratulating him- or herself on another state or country added to the QRP list. You are going to lie down for a few minutes to settle your jangled nerves before you can face any more radio operations.

To add insult to injury, *they* are the ones who will get the awards. Not you, not the one who was straining and putting out all the effort, but them. That's right, the only reason the contact was made in the first place was that you were willing to work hard while they had it easy, and they get the credit.

This is just not fair. So I have a suggestion to make. From now on, any QRP station that wants an award must work another QRP station running the same amount of power. Then, and only then, will the awards mean anything, and the rest of us will have a longer life expectancy.

"I may be getting old but I'm still pretty sure that the letter 'v' does not have six dots in it!"

Another thing. A few weeks ago I got into a rag-chew on 20 CW with a group of old-timers. Most were using straight keys and a few were using electronic keyers. We were going at a comfortable rate somewhere around 20 wpm. Everybody was easy to copy and it was a pleasure. Later that day I moved up into the General/Advanced portion of 20 CW and worked a few stations. They all were using electronic keyers and going about 15 to 20 wpm. The only problem was that I could not understand half of what they sent. I could not tell where one letter stopped and the next letter began. I may be getting old but I'm still pretty sure that the letter "v" does not have six dots in it.

This is just not fair. So I would like to propose another "Q" sign. To QSD, which means "Your keying is incorrect, your signals are bad," we add QSC. QSC would mean "Your keying is so sloppy it doesn't even resemble Morse code—come back when you have learned how to send, 73 and good riddance."

There you are in this massive pileup trying to reach an extremely rare DX station. From your location, it's a part of the world that you have never been able to reach before. He keeps taking list after list and you have been trying for at least 20 minutes. Finally, just before you are ready to give up, you hear your call as number 10 on the new list. Patiently you listen to one station after another exchanging callsigns and

Continued on page 86

A Krystal Kludge

A book excerpt from The Xtal Set Society.

William Simes WØIZC
9320 Lowell
Overland Park KS 66212

As long as I can remember, building things has been a favorite pastime. As a kid, building things from junk was a necessity. As a retiree it's a fascination which led to the assembly described here. Hopefully, some of the findings will be of interest to xtal set experimenters.

The circuit is shown in **Fig. 1.** It consists of a loop antenna, a tuning capacitor, a detector, and a sound transducer. The components are interconnected with clip leads (Radio Shack™ part number 278-1156).

The loop

Our house is located three miles from WDAF and six miles from KMBZ. Both are five-kilowatt stations. I was pleasantly surprised to receive signals from each station using only a tuned loop antenna with a crystal detector. This was particularly surprising because the loop was in the basement! Of the loop configurations I've tried, the one shown in **Fig. 2** and **Fig. 3** is my favorite. The taps at each turn can be used for changing inductance and for load matching. The loop can be readily removed from its base for storage. In my case, when the loop is not in use, it hangs from two hooks fastened to a basement ceiling joist. The base stores easily between joists. The maximum inductance of the loop is about 210 μH. Lower values of inductance are accessible using the taps. As measured from the outside (no. 1 tap) to the Nth tap, the inductance is approximately 2.25 x N^2 μH.

The capacitor

To my knowledge, the capacitor used here is unique. In an attempt to make the capacitance of a Leyden jar variable for the tuning loop, I covered the outside of a half-gallon fruit jar with Reynolds® wrap, put a copper strip inside, and connected the strip and foil to the loop terminals. This was paralleled with headphones in series with a diode. I listened as saturated salt water was poured in the jar. Sure enough, as the level rose, stations came and went. When I replaced the fruit jar with a two-liter soda bottle, performance improved. The bottle capacity changed about 100 pF for each inch change in electrolyte level. The inconvenience of a one-way variable capacitor, operated by pouring electrolyte from one container to another, left too much to be desired. What was needed was a sealed bottle that allowed capacity to be increased or decreased without electrical connections to the electrolyte. The need was met with the holder and bottle configuration shown in **Photo** A.

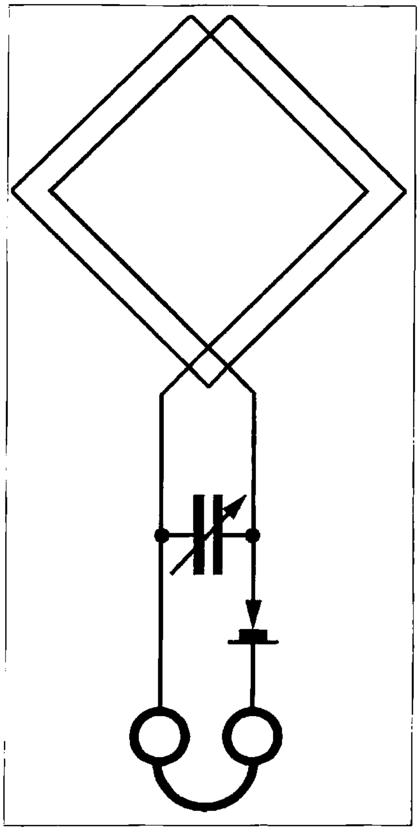


Fig. 1. Schematic of the Krystal Kludge set.

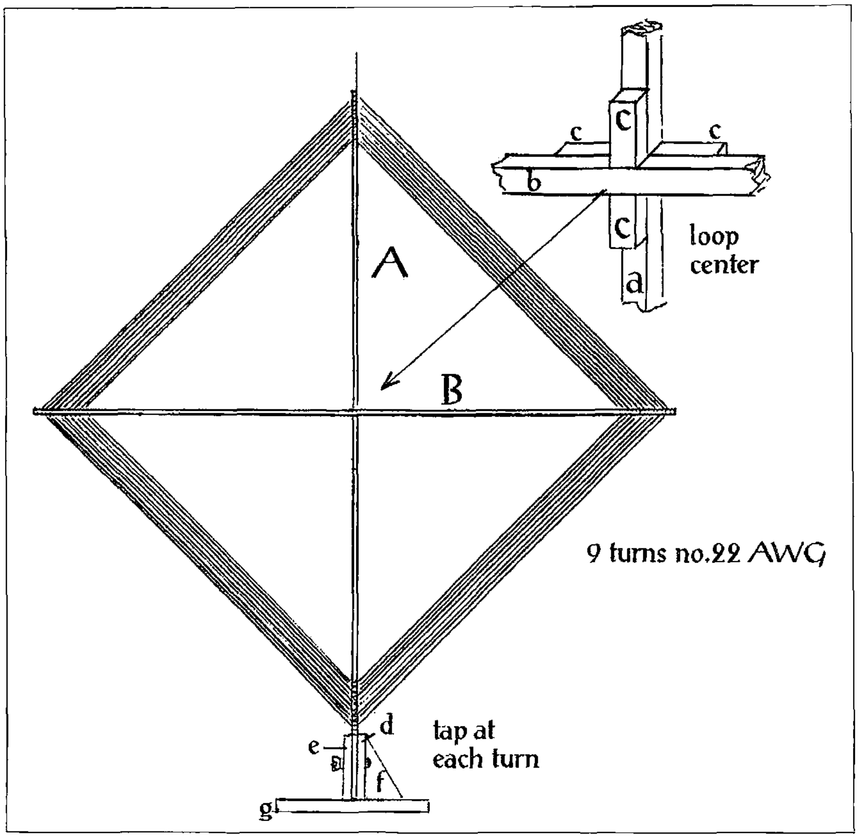


Fig. 2. Loop antenna.

The base assembly is straightforward. Its function is to hold the bottle so as to allow its axial rotation while positioned horizontally. Preparing the bottle to make it a capacitor may take some patience. Here are some suggestions: First, fill the bottle with hot (55°C) water; usually hot tap water will work. In a short time heat from the water softens the adhesive that holds on the label and bottom cup (if there is a bottom cup). Next, remove the label (and the cup) and, with the hot water still in the bottle, clean off any residual adhesive using Gumout™ (or other suitable solvent) and a paper towel. Two-inch Tuck™ aluminum tape, available at most building supply stores, can be used to form the external electrodes. One side of the tape has an adhesive coating with a paper backing. Once a bottle is cleaned and the aluminum tape is available, follow this procedure:

1) Stretch a rubber band about the bottle and align it to locate the bottle's center.

2) Cut four strips of aluminum tape, each seven inches long. Adjusting the tape position after its adhesive makes contact is difficult, so, before removing the backing, fold over about half an inch of tape along its long edge. Make the fold with the backing on the outside of the fold.

3) Carefully remove the backing from all but the half-inch fold-over.

4) Pull the tape taut and align its unfolded edge with the lower edge of the centered rubber band. Apply the tape to the bottle.

5) Once the tape is in place, remove the backing from the folded section.

6) Remove the entire backing from another seven-inch length of tape. Pull the tape taut and align its edge with the exposed adhesive on the folded edge of the tape already in place. Make the contact between the two strips of tape and between the second tape and the bottle. Smooth out any wrinkles.

7) Repeat this procedure to apply the electrode to the upper half of the bottle.

8) Fold up the corners of the half-inch ridges on both electrodes. This exposes some electrode surface without adhesive, allowing clip lead contact to both halves of each electrode.

An electrolyte is needed to complete the electrolytic variable capacitor. Saturated salt water works. It is cheap and it is benign. I found the unloaded signal level of a local station tuned with the salt water capacitor to be about 27 mV. The same station tuned with an air dielectric capacitor showed an unloaded level of about 150 mV. By adding 21 ohms in series with the air capacitor, the signal level matched that of the salt-water capacitor. There are,

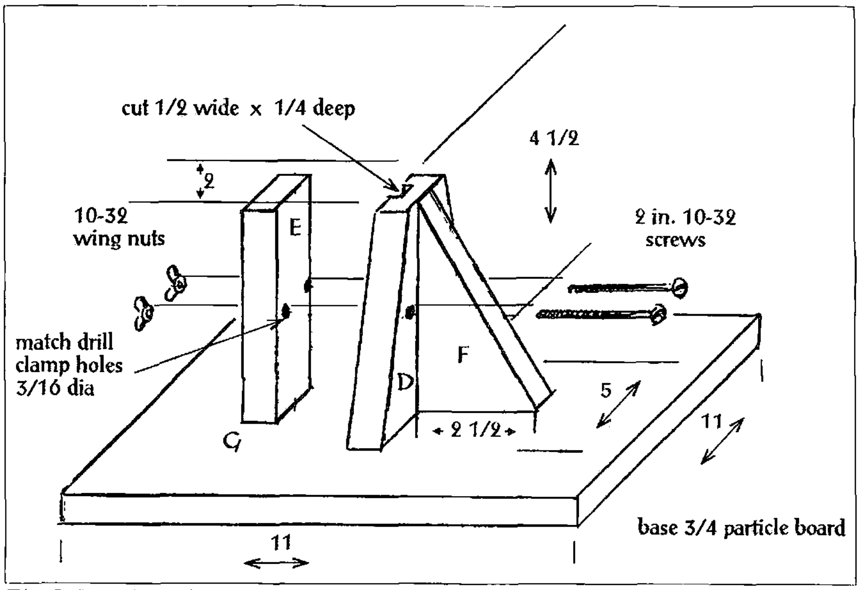


Fig. 3. Loop base detail (dimensions in inches).

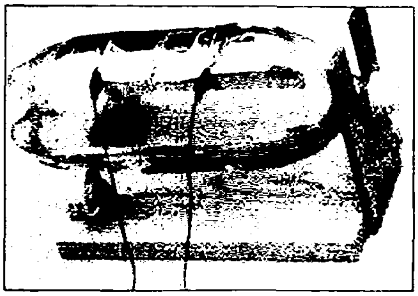


Photo A. Capacitor assembly. Bottle rests on 1-5/8-inch casters.

of course, stronger electrolytes. Here is one that worked better:

One quart of water was added to an empty bottle with external electrodes attached as described above. To this, 100 ml of muriatic acid (31.4% HCl) was added. It behaved as a capacitor, but the capacity didn't change much when the bottle was rotated. The conductive wet coating inside the bottle left the electrolyte area inside the bottle poorly defined. This was corrected by adding a pint or so of kerosene which provided an insulating layer that floated on the electrolyte. The capacity then changed as expected when the bottle was rotated. The signal degradation using this capacitor was equivalent to adding six ohms to the air capacitor. Its tuning range was about 100 to 480 pF. Oil floating over the electrolyte further reduces the trapped air volume and the bottle distortions associated with temperature-induced volumetric changes. On the other hand, it also tends to increase weight. Replacing the base cup on the bottle could prevent this distortion.

The detector

The 1N34A diode is handy, cheap and works every time. However, for the purist bent on a junk assembly, try this. It's tacky, but it worked for me. Find a mousetrap, preferably one that hasn't served its intended purpose. Remove the bait holder and trip wire. That leaves only the spring-load rectangular business piece. This wire piece is then used to hold the galena firmly against the wood base. In so doing, it makes good electrical contact with the galena and provides a contact on which to fasten a clip lead. A small jelly glass with a suitable length of fine wire fastened to its top with a rubber band makes a functional cat whisker. After a few turns of the fine wire on the clip lead clip, the edge of the glass makes a good anchor for the clip lead (**Photo B**). The fine wire can be removed from a section of stranded hookup wire. Now position the jelly glass assembly so the cat whisker makes the right contact with the galena and you have a detector. Again, it's tacky, it's functional, and it's sometimes a good conversation piece for an otherwise uninterested visitor.

The transducer (headphone)

High-impedance store-bought headphones work well. For the purist again, the piezoelectric transducer made from a cat food can is recommended. Such a device is detailed in Vol. 6, No. 3 of the *Xtal Set Society Newsletter.*

As a rural kid, I could only get Dr. Brinkly on my crystal set. Now I'm

Photo B. Krystal Kludge set.

geographically blessed with a location where a crystal set can receive many stations (not always better programs). A more geographically challenged crystal set experimenter may need younger ears to share my results.

William Simes' article is an excerpt from the Xtal Set Society's new book, Crystal Set Projects: 15 Radio Projects You Can Build. *You can check out more crystal set projects and the Society's bimonthly newsletter at [www.midnightscience.com]. The book is available for $17.45 including shipping directly from the Xtal Set Society, P.O. Box 3026, St. Louis MO 63130, or call (800) 927-1771.*

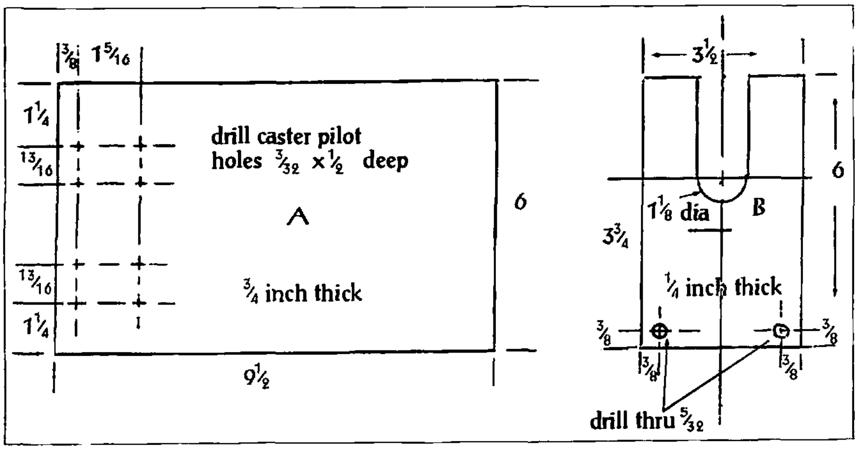


Fig. 4. Details of base for capacitor assembly (dimensions in inches).

73 Review

Number 68 on your Feedback card

Advance Design Labs' CodeKey

Put this gizmo to work for you!

Michael Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

There's much controversy these days over if and when Morse code, or CW, will be phased out of amateur radio licensing requirements. Whatever your stand on the issue, the fact is that Morse code is still quite popular on the HF bands, and it shows no prospect of disappearing, even if it winds up no longer being a requisite for entry into the hobby. Tune down around 14.010 MHz or so any time the 20-meter band is open, and you'll hear plenty of signals. If you're like many of us, though, you may not have used code enough yourself to keep up your receiving skill. Ever wonder what those 35-wpm spectrum blasters are actually saying?

If you can't keep up by ear, there's always your trusty computer. CW-decoding software is pretty much free for the asking. But, how well does it work? If you've tried the software-only approach, you've discovered that it works pretty poorly. Sure, if the sender is also using a computer to generate perfectly timed code, and there's absolutely no QRM (yeah, right!), you'll get some of the text, and might even be able to figure out what's being said. In general, though, computers make lousy code copiers. Why?

Not meant for machine

With its variable-length characters and peculiar timing, Morse code was never intended for machine copying. While a well-trained brain can do amazing things with it, the code just doesn't easily fit into the regimented, consistent way a machine interprets information. Does that mean it's impossible to do any better than common code-copying software?

No! In fact, it's quite possible for a specially-tailored machine to do a respectable job of copying Morse. Advance Design Laboratories, Inc. realized this and created its CodeKey CK-53. This product is much more than the usual phase-locked-loop modem whose output is fed to generic software. This little board has its own microprocessor, and is dedicated solely to the processing of CW. It outputs ASCII characters ready for computer display, rather than the ons and offs of Morse itself. Although best used with a PC, it can even be used with dumb terminals (although you lose the keyer functions), since all the decoding intelligence is on the board, rather than being in the computer.

Almost ready to go

The board comes pre-assembled. Like many modern electronic products, it's built to a density scale that would be pretty hard for most home-brewers to cope with if they had to build it from a bag of parts, and the instructions state that it's not for the inexperienced user. I found, however, that it was quite simple to connect and use, and I think anyone who can solder properly and wire up a DB-25 connector should have no trouble with it. Beyond soldering on a couple of LEDs and wiring up the cables, there's nothing to do. It's almost ready to go, right out of the box.

Software for DOS computers is included. Unlike so many bloated programs these days, the disk has just two files, and one of them's an automated installer. Installation is a snap.

What it is

So, if it's not just another Morse modem, exactly what is this thing? The best analogy I can think of is that it's the Morse code equivalent of a packet TNC. Being microprocessor-based, it has many commands and settings that

let you tailor it to your specific use and style, just like a typical TNC. Although it doesn't use DSP technology, the reader employs a CMOS digital phase-locked loop and analog filters controlled by the on-board micro. For instance, you can set the noise threshold and the analog gain, and even the PLL bandwidth has wide and narrow settings! That sort of close interaction between the analog, PLL, and microprocessor stages is what gives this device such an advantage over the modem-and-software approach.

Upon first opening the very well done manual, all those options looked a bit daunting. As it turned out, though, the thing worked quite well with its default settings, and I didn't have to set anything beyond my comm port in order to view code on my screen.

The device can receive at speeds beyond 35 wpm. It has a 512-byte (character) transmit buffer, and about 8 k of saved message buffers. It can transmit files from disk (so you won't have to manually send that brag file over and over), and will even automatically ID your station every 10 minutes. It can log received data to disk. There's even an on-screen tuning indicator, along with the tuning LEDs on the unit. As a keyer, it offers relay-isolated contacts, and will send at whatever speed is being received unless you tell it otherwise.

As I mentioned, the manual is very well done. It's in 8-1/2 by 11-inch format and stapled together, which seemed chintzy to me until I started using it. Then, I found it handy to have such big pages, and the lack of a binding let the book stay open to whatever page I picked. Excellent drawings of the board and connector layouts made wiring up cables easy. Connections are shown for both 25-pin and nine-pin PC-style connectors. Sadly, no hookups for Mac are shown, nor is there any Mac software. Most hams are using PCs, so I guess they concentrated on that platform. Explicit instructions are given for making all of the connections. I, for one, regard good documentation as a tremendous plus for any product, and this one's a winner, despite a few typos.

Let's do it

OK, I had everything wired and running. I powered up the board from my benchtop 12-volt supply. Now, I tuned the band and, hey, it's reading code! Signals my old modem-and-software system wouldn't have made any sense out of, this thing decoded very decently. The LEDs made it easy to tune the rig to the optimum point for the device's filters, even without glancing at the on-screen tuning indicator.

Performance

No code reader can beat the human brain, nor should you expect it to. Well-sent code was displayed nicely, but even the best code often had words run together. Weak signals decoded better than I'd expected, but there were plenty of errors when signals faded down low or QRM got heavy. The unit did a surprisingly good job of reading hand-sent, straight-key code, but it did not do well with "swung" Morse, in which the sender alters the normal 3:1 timing relationship of dots and dashes. In all fairness, my own personal "wetware" decoder doesn't do too well with that either! Luckily, few operators swing their timing anymore (thank goodness).

The keyer portion of the device is much like other memory keyers, which is to say it's quite nice. It lets you put received data, such as name, QTH, or callsign into the transmit buffer, so you won't have to retype it. All functions are controlled from the computer keyboard, and the relay-isolated output lets you connect the unit to tube rigs or those with unknown keying requirements, without worrying about blowing anything up.

Summary

This is a well-done product that can enhance your ham radio experience. It could also be successfully used on the shortwave bands, letting you see what all that high-speed code is all about. (Of course, you're out of luck if the signal is encrypted.) It does a very respectable job of decoding CW, and it beats the old modem-and-software routine any day of the week. If you like CW, check this thing out!

To do so, contact:
Advance Design Labs, Inc.
4785 Dolores Ct.
Cocoa FL 32926
(407) 636-8096
FAX (407) 690-0047.

Above & Beyond

continued from page 63

oven are inserted into a controlled-temperature chamber. In many circuits, the device used is nothing more than a sophisticated custom-made Thermos™ bottle with a hole through the sealing cap for bringing leads out to run the circuitry.

Actual construction of the device containing the oscillator would look like a three dimensional sandwich containing the inner oscillator circuit, protected with some insulation, and covered by the first inner oven. Then more insulation such as Styrofoam™ and the outer oven and still more insulation like a thermal blanket to hold the unit snugly in the Thermos bottle. It's kind of like constructing a ship in a bottle, but making sure that everything is insulated (thermally) from each other, and that all voids are minimal.

Can we duplicate the circuitry or is this too complex? Yes we can, if we start out with an oscillator circuit that is not a simple unit but has several stages to isolate the oscillator from the output, and incorporates voltage regulation! We ran into a suitable unit, a 10 MHz TCXO oscillator that had internal temperature adjustment and 10-volt voltage regulation. The oscillator was made to function on +12 volts and ran on 35 mA of current so as to not produce much heat on its own account. There is a variable capacitor access hole on the oscillator side to set the unit to frequency.

Construction can be as simple as placing an insulated unit on its own in a Thermos bottle and letting the ambient temperature do its trick. Or you could create a very slow time-constant single oven to maintain some preset temperature above a normal high ambient, say 90 degrees. Why slow time-constant temperature control? Because a fast temperature control will overshoot its mark and be running continually, either trying to catch up, or (when it cools down), trying to reheat the unit.

A very slow control reacts over a longer time period and will ultimately remain quite fixed at some mean temperature point you select. This will continue when inserted in a Thermos bottle, as it, and all the components in the bottle, will maintain the same temperature.

If you have an oscillator already, or have put together something similar to this, I outlined previously how you ensure you have a good accurate unit.

There are several methods to accomplish the necessary calibrations for achieving a specific point of stability in your oscillator. Time and frequency standards are broadcast by the government's National Bureau of Standards, now renamed NIST. The calibration of your oscillator can be accomplished by comparing it with one of these transmissions. The simplest of them all is WWV, which broadcasts frequency standard information at 5, 10, 15, and 20 MHz exactly. Their frequency is compared at the source to extremely accurate reference oscillators.

To compare your oscillator, you only need a receiver capable of receiving these frequencies and to make an audible beat note adjustment minimizing the difference between your oscillator and WWV. This method is capable of making an adjustment that is accurate to 1 part per MHz. Not too bad, but this is just the start of what could be a very accurate comparison.

The reason you are not able to make exact reference is that on these frequencies transmission via the atmosphere affects the exact frequency and changes it slightly. A more accurate transmission is at the VLF or Very Low Frequency of 60 kHz. Here the atmosphere does not impart as much of a change on the signal and better resolution can be obtained. Other sources include LORAN, GPS (Globally Positioned Satellite), or even calling up NIST on the telephone and obtaining voice time readings. There is even a service on the Internet that will adjust the clock of your computer to exact or nearly exact time.

More information can be obtained from the NIST information published on their Internet page at [http://rio.bldrdoc.gov/timefreq/]. This is the best informational page covering most of the frequency standard information that is available—and it's free. Can't beat that for good information, so give it a look-see.

Just in case some of you can't locate a suitable oscillator for trying some of these methods that I have covered, I will be glad to provide one for experimentation. I have come across a suitable oscillator with specs that are quite good. I have a large number of "pulls" that were rejected for one reason or another. I suspect these units fail to meet original temperature specs over a great range. I have short-term tested them and junked any that fail to function, are way off frequency, or have any other malady. Instead of

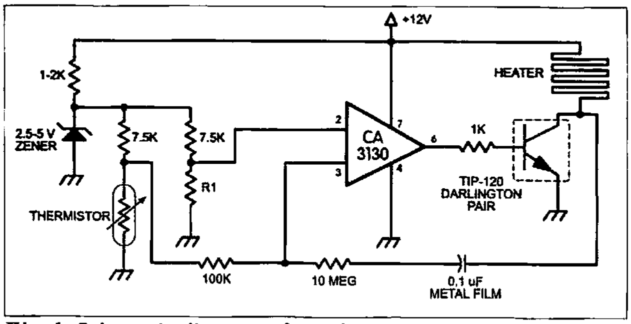


Fig. 1. Schematic diagram of simple one-stage temperature control circuit using a 3130 op amp. R1 is selected to reflect the temperature of the thermistor's resistance at the calibration point selected. The heater can be a large number of turns of #36 enamel wire or nichrome resistance wire to provide a suitable load (10 to 20 Ω) for the TIP-120 Darlington transistor. The thermistor selected was a 10 k Unicurve™ device, but others will work. It should be in direct thermal contact with the oscillator's metal container for best results. R1 = thermistor temperature at regulation point. For example, if thermistor used is 678 Ω @ 100°, then R1 = 678 Ω.

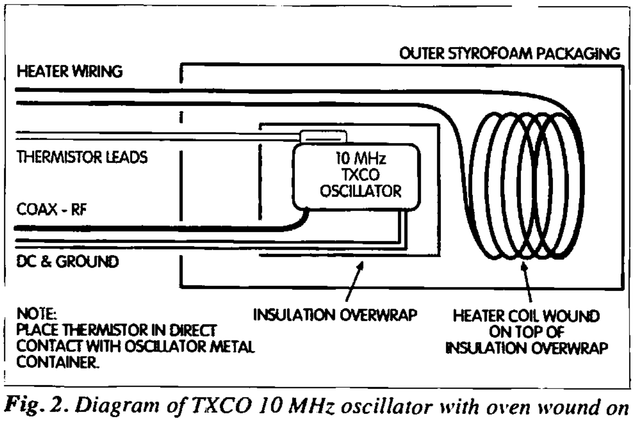


Fig. 2. Diagram of TXCO 10 MHz oscillator with oven wound on outer case of main oscillator. Wire insulated from main oscillator and complete unit packed in Styrofoam insulation before insertion into temperature-controlled chamber (Thermos). Cut small holes for leads to exit bottle through plastic cap.

getting into labor-intensive testing to certify them better, I will make them available for $10 (US) each postpaid.

Whether you purchase one of these units or use one you have on hand, the principles are the same in the construction of a reference oscillator. The only possible changes relate to size, operating voltage, and stability of the oscillator you locate. Give it a try—I'm sure you will be pleased with the results, even if you house your existing oscillator in a Styrofoam compartment. Home-brewing can be lots of fun, and a good, stable crystal oscillator can be a valuable asset to your test bench as an aid to calibrating receivers or as a standalone reference.

A parting thought would be to include a mention of the crystal that is selected for one of these very high accuracy units. Crystals are cut from raw material at different angles, and different cuts give different effects. The crystals chosen for primary frequency standards are specifically cut to exacting standards and are not likely to be found separate from the units they are used in. Crystals need constant attention as they "age" as time goes by and need readjustment from this age effect. As crystals get older, they either drift off frequency or become quite stable or "aged" in.

Remember, anything you do to improve the stability of your current oscillator will be beneficial to your station and your frequency calibrations. I hope this gives you some idea of what is going on in a commercial standard (and why they're so expensive).

Well, that's it for this month. Next time, I plan to get into filters for our lower microwave bands, passing on some interesting details on filters I have constructed and comparing them to some very high-quality ones currently being manufactured for these amateur bands. If you have questions, just drop me an E-mail. 73, Chuck WB6IGP.

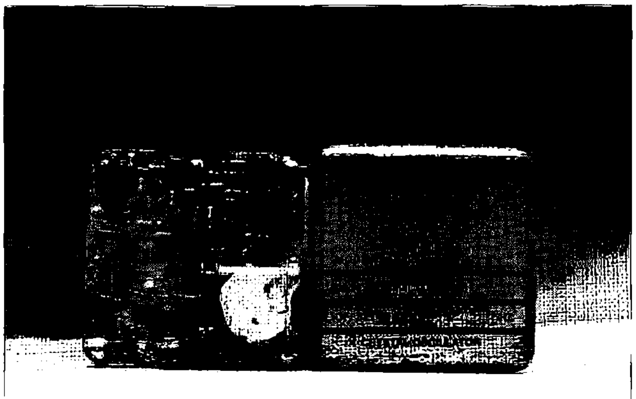


***Photo A.** Surplus 10 MHz TCXO oscillator from EG&G used in this example. Unit on left has case removed to show internal components. White thermal compound on crystal is hiding part of temperature-controlled components for internal original control of temperature/frequency. Unit requires 12 volts DC at 35 mA.*

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
P.O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Last year, we were looking at the "orphaned" status of owners of AEA equipment, with the demise of that company. With many of you having a PK-232 in the shack, this became more than a trivial problem.

Take the case of Ed Williams WB4GDH/mm/VK6AJR, who writes:

"I read your 'RTTY Loop' in *73 Magazine*. A friend of mine on another ship here in MED/SEA wants to buy a PK232MBX, but it looks like AEA went out of business and stopped making them. Do you have any idea where he might pick up one, or something similar? We only have E-mail here through the military E-mail system and can't get on the Internet with our setup."

Well, Ed, first of all let me compliment you on the VK6 callsign, I do like the suffix! As I indicated in the November 1997 column, Timewave, Inc., purchased all of the assets of AEA. This leaves us with two different issues: repairing older equipment, and purchasing new gear.

For the ham with older AEA equipment, Timewave has expressed a liberal repair policy. They indicate that they can provide repair services on all products built by Timewave, and most data products built by AEA since 1990. Their ability to repair AEA data products, such as multimode data controllers and TNCs, is limited by parts availability and special test equipment to test the products. Timewave has a limited supply of AEA custom parts that will be used until the supply is exhausted. In most cases it is not possible nor cost-effective to obtain a new supply of custom parts.

Unfortunately, Timewave has few, if any, parts available for products like the MP-64 and Doctor DX, which were built for Commodore computers. They suggest you consider updating to a PC-based system. Very low cost used PC equipment is readily available at ham swapfests and on-the-air ham swap nets.

By the way, as stated before, the AEA antenna and Antenna Analyzer product line was acquired by a different buyer, Tempo Research of Vista CA. Any service or upgrade requirements on those items should be directed to:

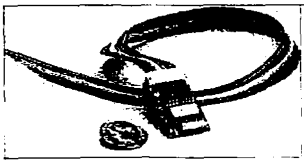
AEA
Tempo Research Corporation
1221 Liberty Way
Vista CA 92083
(760) 598-8900
FAX (760) 598-4898

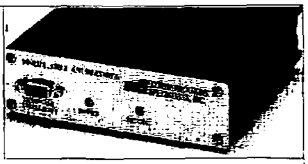
AEA sold a variety of products over its 20-year history. Timewave cannot repair most of the non-data products because they have few spare parts, but they may have technical data on those products. Their working knowledge of the non-data products usually will be quite limited. Please inquire about specific products.

In particular, the antenna tuner products, the LA-30 linear amplifier and the WM-30 SWR/power meter were manufactured by Vectronics in Canada for AEA. Vectronics is now owned by MFJ. They suggest you contact MFJ to check on the availability of spare parts for these products. You may have to determine the equivalent Vectronics model number to get help from MFJ, since

Continued on page 74

NEW PRODUCTS

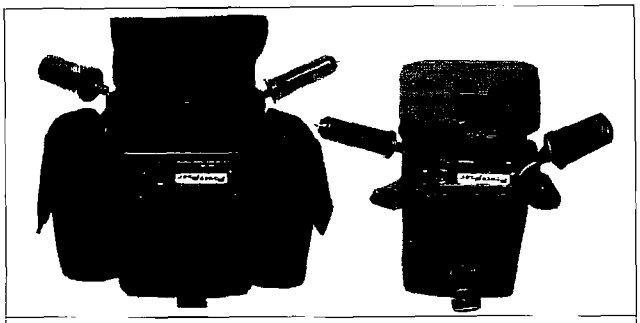




ANI-1 Can Do It!

Communications Specialists' ANI-1 miniature automatic numbering identification encoder is a microprocessor-based PCB that provides instant identification of mobile and portable two-way radios—a simple, economical way for public service, utility and delivery companies (among others) to identify system abusers and manage airtime more efficiently. The postage stamp-sized ANI-1 uses a high-speed multi-tone sequence for data transmission on an RF channel and is compatible with links and repeater systems.

Incoming unit ID and status message transmissions can be decoded and displayed on a personal computer by using the ANI-2 Station Decoder, which displays up to 100 received messages on your computer screen in real time. It comes complete with programming kit, including all cables, software programming disks, and power supply, and, like the ANI-1 Encoder, is available with immediate one-day delivery and a five-year warranty. The ANI-1 Programmable Encoder is priced at $39.95; the ANI-2 Station Decoder is $299.95; fleet pricing is available. For more information or to order, contact Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92865-4296. Call (800) 854-0547 or FAX (800) 850-0547 from the US and Canada; overseas customers may call (714) 998-3021 or FAX (714) 974-3420.



Beef Up Your Handheld

The power of a 35-watt base station with your two-meter handheld? Sounds too good to be true, but Cutting Edge Enterprises has done it—and it won't require a second mortgage! Just plug your handheld into the PowerPort RF-35, grab the carrying strap and take it wherever you go. The removable side pockets hold your HT and accessories.

The rechargeable RF-35 is fully self-contained, with nine amp-hours of on-board 12 VDC power so you can keep communications going all day, without a break. With two and a half hours of solid transmit time and unlimited standby, the RF-35 will outlast your handheld battery! If you don't need that much stamina and want something even lighter, the RF-35 Jr. will still give you three quarters of an hour of talk time and unlimited standby, and it only weighs three pounds.

The PowerPort RF-35 is ready to go, right out of the box. It's fully charged and comes with an RG-174/U cable with BNC connector for your HT, and a mini "J" antenna is tucked into one of the accessory pockets—instant fun or emergency communications for only $179.95! The RF-35 Jr. is $159.95, and both are available from Cutting Edge Enterprises, 1803 Mission Street, Suite 546, Santa Cruz CA 95060; telephone (800) 206-0115 for more information or to order.

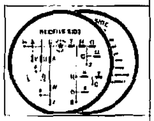
MFJ Expands Time!

Well, the numerals on the clock face are bigger. Seriously, the MFJ-118 JUMBO LCD™ 24/12 hour ham station clock has high-contrast digits one and a quarter inches high—you'll be able to read them from anywhere in your ham shack. You can choose whether you want 24-hour UTC or 12-hour format; the MFJ-118 also displays year, month, date, and day of the week—in English, Spanish, German or French.

The MFJ-118 has a 100-year full calendar and is quartz-controlled for accuracy. The tough black plastic case is only five and three quarters inches by two and a half inches by half an inch thick, and it'll stand up or hang on the wall. It uses an easily-replaceable AAA battery, and of course it comes with MFJ's famous "No Matter What" one-year warranty.

For your nearest dealer or to order, call toll-free (800) 647-1800; FAX (601) 323-6551; or write to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville MS 39759. Check out the Web site at [http://www.mfjenterprises.com].

Don't Toss This Coin



Here might be the way to introduce someone you love to Morse Code. This "Decoder Coin," from Hall Brothers Manufacturing Company, has an alphabetically arranged "send" side and a logic trail "receive side" that makes it easy for even a beginner to follow the dots and dashes to find the correct letter. The instruction sheet is brief and clear, and Hall Brothers left space on the brass coin to drill a 1/8-inch hole to make a key chain or zipper pull of it. For ordering information, contact Hall Brothers Manufacturing Company, 380 N. 400 E., P.O. Box 1010, Morgan UT 84050-1010; telephone (801) 829-3232 or FAX (801) 829-6349.

Free Catalog from MCM

MCM Electronics, founded in 1976, has just released its newest catalog, featuring more than 4,000 new products, including project accessories, semiconductors, connectors, test equipment, and electronics parts. Now, among the 37,000 in-stock items, you'll be sure to find the brands you know and trust—and MCM offers same-day shipping on (in-stock) orders received by 5:00 p.m. For a free copy of the newest catalog, write to MCM at 650 Congress Park Drive, Centerville OH 45459-4072; or call (800) 543-4330.

Number 74 on your Feedback card

Carr's Corner

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

More on magnetometers

Previously, this column has discussed the model FGM-x magnetic fluxgate sensors sold by Fat Quarters Software, 24774 Shoshonee Drive, Murrieta CA 92562, USA; (909) 698-7950 (voice) and (909) 698-7913 (FAX). Erich Kern of Fat Quarters recently sent me a recording he made of some sort of magnetic event. Checking with some experts on the matter revealed that it was a severe magnetic storm. Some ham operators use magnetometers (some very crude) for propagation studies. Let's talk a little about calibrating and using these instruments (besides, even if you don't want to use the magnetometer for propagation studies it makes a dandy science fair project!).

Calibration of the sensors

The FGM-x devices are not precision instruments out of the box, but can be calibrated to a very good level of precision. The calibration chore requires you to generate a precise magnetic field in which the sensor can be placed. One way to generate well-controlled and easily measured magnetic fields is to build a coil and pass a DC current through it. If the sensor is placed at the center of the coil (inside), then the magnetic field can be determined from the coil geometry, the number of turns of wire, and the current through the coil. There are basically two forms of calibrating coil found in the various magnetic sensor manuals: solenoid-wound and the Helmholtz pair.

Fig. 1 shows the solenoid coil. A solenoid is a coil that is wound on a cylindrical form in which the length of the coil (L) is greater than or equal to its diameter. This type of coil is familiar to radio fans because it is used in many L-C tuning circuits. The magnetic field (H) in Oersteds is found from:

$$H = \left[\frac{4\Pi NIL}{10\sqrt{L^2 + D^2}} \right]$$

Equation 1

Where:

H is the magnetic field in Oersteds.

N is the number of turns-per-centimeter (t/cm) in the winding.

I is the winding current in amperes.

D is the mean diameter of the winding in centimeters (cm).

The winding is usually made with either #24 or #26 enameled or Formvar®-covered copper wire. The length of the solenoid coil should be at least twice as long as the sensor being calibrated, and

RTTY Loop

continued from page 71

Timewave has no cross-reference information available.

All units which are damaged beyond repair (examples are lightning damaged, burned circuit board traces, and fire damaged) will be returned to the owner with no charge and a letter stating the unit is not repairable. The letter will contain the manufacturer's suggested retail price and the model number of the current Timewave product that is functionally equivalent to the damaged unit. This information is usually required by insurance companies in order to file a claim for replacement of a damaged unit.

Checking their Web site at [http://www.timewave.com/amprods.html] yields the information, for example, that upgrading an old PK-232 to the latest generation of PK-232MBX costs just $100, and includes a hardware upgrade and manuals.

So, it would seem that Timewave has given a new life to users of AEA equipment. Check out their Web site, or give them a call at (612) 452-5939 and tell them that you read about it in "RTTY Loop"!

Regards to Jon A. Moreshead KA3JNZ, who passes along the observation that a program which may help Ted Bear W6RHB with his V20 laptop is Super Morse, a program written in Turbo Pascal for IBM compatibles. It can be configured for use via the COM port with a simple interface, the diagram for which is included in the DOC file. This program is on Disk #7 of the RTTY Loop Software Collection, and is an excellent Morse program. Thanks, Jon!

While we're talking about handy software, Bob Lewis AA4PB passes along the information that he "ran across a terminal program you may wish to let the readers know about. It's called EasyTerm for Windows™ and it now supports the HAL P38 Clover card as well as a number of other controllers."

EasyTerm is a Windows program that supports the AEA, Kantronics, and HAL controllers. It appears to support all of the options and modes of the individual controllers, and features ANSI color displays and a host of other features. There are even built-in logging and contesting modules. All of this can be yours for about $50. You can review the information about the program on the Web site at: [http://www.tiac.net/users/henley/eztpage.html].

After you purchase the program, the author states that updates are free of charge. Check it out, and let me know what you all think.

Another program discussed here a while ago was BMK Multy. Well, discussed and discussed is more like it. I have mentioned this program, and hinted about it, but have not been able to point anyone in the right direction. Well, thanks to Jerry KØHZI, we now have an address. The USA distributor is:

Schnedler Systems AC4IW
25 Eastwood Rd.
P.O. Box 5964
Asheville NC 28813

and the address for the author, G4BMK, is:

Grosvenor Software G4BMK
2 Beacon Close
Seaford, E. Sussex BN25 2JZ
England UK

I hope this helps out some folks who have been looking for this somewhat elusive piece of software.

When it comes to software that is less elusive, though, don't forget to check out the RTTY Loop Software Collection, mentioned above in conjunction with Super Morse. This growing collection of programs of interest to the digital amateur spans a dozen and a half disks. Check out the full list online at the RTTY Loop Home Page [http://www2.ari.net/ajr/recs/] or send me E-mail at the above E-mail address, or send a self-addressed, stamped envelope to the post office box, and I'll send you a copy of the list.

I appreciate your continued support of this column, now nearing the end of twenty-one years of continuous presence in *73 Magazine*. Through the years we have covered every aspect of digital communication from Model 15s to Pentium IIs, and we still have more to do. Let me hear from you about yesterday's, today's, or tomorrow's "RTTY Loop."

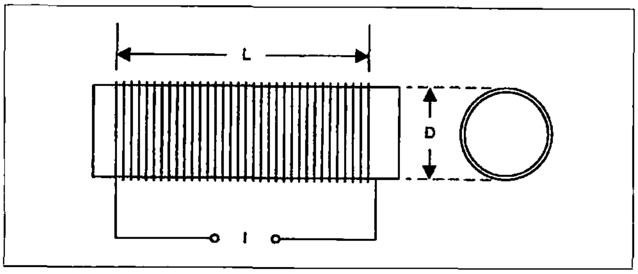


Fig. 1. Solenoid coil.

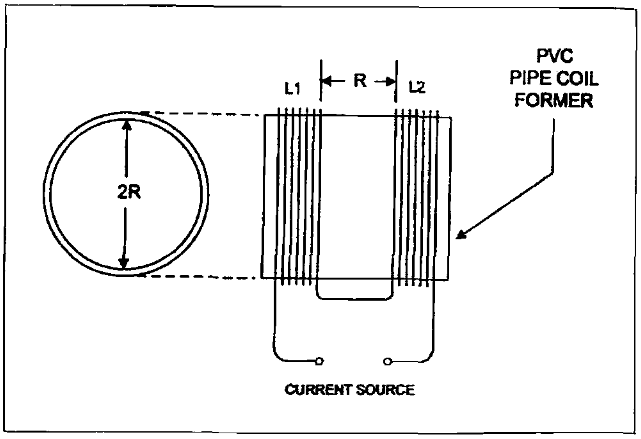


Fig. 2(a). Helmholtz coil.

the sensor should be placed as close as possible to the center of the long axis of the coil.

The Helmholtz coil is shown in **Fig. 2(a).** It consists of two identical coils (L1 and L2) mounted on a form with a radius R, and a diameter 2R. The coils are spaced one radius (1R) apart. The equations for this type of calibration assembly are:

$$H = \frac{0.8991NI}{R}$$

Equation 2

and

$$B = \frac{9.1 \times 10^3 NI}{R}$$

Equation 3

In the practical case, you usually know the dimensions of the coil, and need to calculate the amount of current required to create a specified magnetic field. We can get this for the Helmholtz pair by rearranging **Equation 2:**

$$I = \frac{RH}{0.8991N}$$

Equation 4

The coils are a little difficult to wind, especially those of large diameter (e.g., four inches). One source recommends using double-sided tape (the double-sticky stuff) wrapped around the form where the coils are to be located. As the wires are laid down on the form they will stick to the tape, and not dither around.

Fig. 2(b) shows the type of assembly that can be used for either the solenoid or Helmholtz coil. I first saw this type of assembly in a college freshman physics laboratory about 25 years ago. It consists of a PVC pipe section used as the coil former. End caps on the coil former also serve as mountings. The mounts at either end consist of smaller segments of PVC pipe and nylon (nonmagnetic) hardware fasteners. Another segment of PVC pipe, of much smaller diameter than the coil former, is passed through the former from one end cap to the other, so that its ends protrude to the outside. This pipe forms a channel into which the sensor can be placed. The base is a plastic or wooden box (again, nonmagnetic materials). One thing nice about this type of assembly is that the sensor is always in approximately the same position in the coil, close to the center of the field.

A magnetometer project and kit

Fig. 3 shows the circuit for a simple magnetometer based on the FGM-3 fluxgate sensor. It can be obtained in kit form from Fat Quarters Software. The connections to the printed circuit board are shown in **Fig. 4.** This device takes the output frequency of the FGM-3 and passes it through a special interface chip (U1), and then to a digital-to-analog converter to produce a voltage output.

The sensitivity switch (S1) produces the following sensitivities when the FGM-3 sensor is used (SI Position/Sensitivity): 4/±150 gamma; 3/±250 gamma; 2/±550 gamma; and 1/±1,000 gamma.

These ranges translate to a DC output voltage between 0 and +2.5 volts. If the FGM-3h sensor is used instead of the FGM-3, then divide the sensitivity figures by two. These figures are approximate. If greater accuracy is needed, then each sensor should be individually calibrated.

The heart of this magnetometer project (**Figs. 3 and 4**), other than the FGM-3 device, is the special interface chip, Speake's SCL006 device. It provides the circuitry needed to perform magnetometry, including Earth-field magnetometry. It integrates field fluctuations in one-second intervals, producing very sensitive output variations in response to small field variations. It is of keen interest to people doing radio propagation studies, and who need to monitor for solar flares. It also works as a laboratory magnetometer for various purposes. The SCL006A is housed in an 18-pin DIP IC package.

The D/A converter (U2) is an Analog Devices type AD-557. It replaces an older Ferranti device seen in the Speake literature because that older device is no longer available. Indeed, being a European device, it was a bit hard to find in unit quantities required by hobbyists on this side of the Atlantic. The kit from Fat Quarters Software contains all the components needed, plus a printed circuit board. The FGM-3 device is bought separately.

The external connections are shown in **Fig. 4.** The circuit is designed to be run from nine-

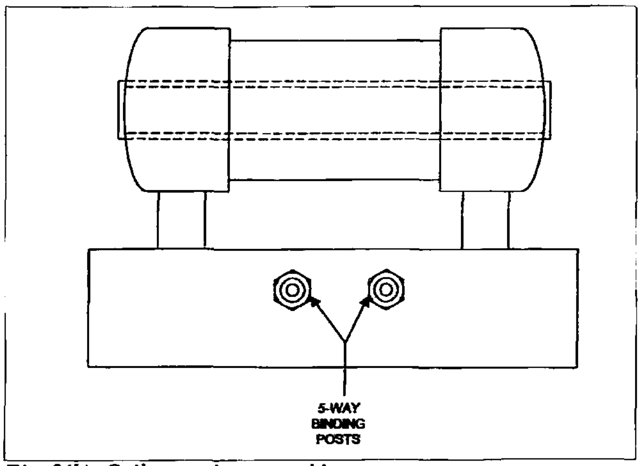


Fig. 2(b). Coil mounting assembly.

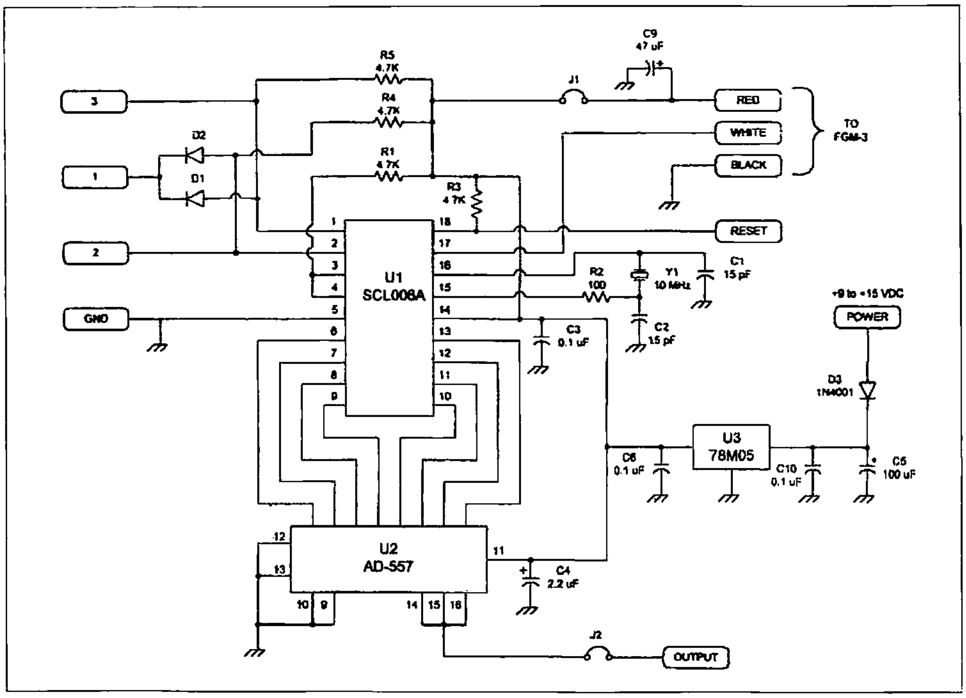


Fig. 3. Magnetometer circuit.

volt batteries so that it can be used in the field. A sensitivity switch provides four positions, each with a different overall sensitivity range. The output signal is a DC voltage that can be monitored by a strip-chart or X-Y paper recorder, voltmeter, or fed into a computer using an A/D converter.

If you intend to use a computer to receive the data, then it might be worthwhile to eliminate the D/A converter and feed the digital lines (D0-D7) from the SCL006A directly to an eight-bit parallel port. Not all computers have that type of port, but there are plug-in boards available for PCs, as well as at least one product that makes an eight-bit I/O port out of the parallel printer port.

Sensor head mechanical construction

When evaluating the FGM-3 sensor, I built a magnetometer using the kit provided by Fat Quarters Software. The printed circuit, switches, and meter were mounted on a small, sloping-front cabinet. The goal was to build a sensor head that could be rotated to find the magnetic field (the FGM-x sensors are direction sensitive).

The solution was to place the sensor inside a 0.75-inch (19-mm) PVC plumbing "tee" connector. Three end caps were provided, one for each port on the "tee." The end cap that was on the down stroke of the "tee" is fitted with a 0.25-inch (6.35-mm) stereo phone plug. When this plug is mated with a phone jack on the top of the project's case, it can be rotated at will.

The sensor is mounted horizontally in the crosspiece of the "tee," while the wires are routed to the down stroke section. The sensor is held centered in the cylindrical PVC "tee" with small plugs made of Styrofoam™ or some other material.

I used a hobbyist's razor knife to carve the larger-size foam "peanuts" of the sort used for packing fragile items for shipping. The finished sensor assembly is mounted on top of the project's case.

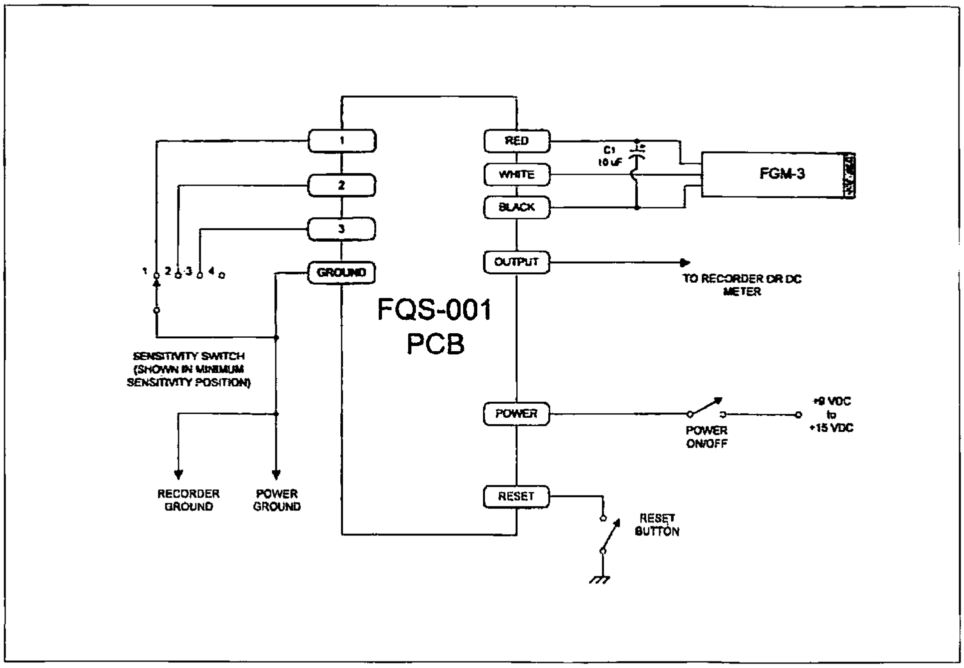


Fig. 4. Printed circuit connections.

Scrounger's Delight

Meet the Minnesota miser's magmount.

Peter A. Bergman NØBLX
3517 Estate Dr. SW
Brainerd MN 56401

Building and experimenting with antennas is a fascinating part of amateur radio. At one extreme you will find enormous steerable arrays for moonbounce or satellite communications and at the other, simple little whips and verticals.

I was planning to build a set of phased verticals for use on the HF bands and decided to do some experimenting and modeling with a two-meter array first. This gave me some experience on the workbench before I had to start procuring the materials and doing the work on the larger antennas.

The first order of business was to produce some quarter-wave magmount antennas. I've built a number of these in the past using SO-239s, grommets and bolts, and what-have-you to mount the whips, and wasn't quite satisfied with the results. I wanted something that was cheaper, more durable, and more weather-resistant than any of these. One day, while waiting to have my car repaired, I found what I was looking for literally lying at my feet—discarded tubeless tire valve stems.

These valve stems meet all the requirements mentioned above and require a minimum of modification to make them part of a really good, home-brewed mobile antenna mount.

The place I usually start with one of these antennas is finding an aluminum can and a magnet that match. I have gotten magnets from defunct speakers, but generally I'm able to get a good supply at hamfests. Sometimes I walk around the supermarket with the magnet looking for cans and sometimes I walk around the hamfest with the can looking for magnets. I get fewer strange looks at the hamfest. Usually. Vienna sausage cans are pretty good and Kiwi cans are sometimes a match too, but I can't eat that much shoe polish.

Once I have a magnet that will just fit into the can I've chosen, it's time to prepare the can. I've used full-sized sausage cans but prefer to lower their profile a bit. Keeping in mind that room must remain for the grommet, coax, magnet, and valve stem base, trim some material from the top of the empty, clean can. A pair of household scissors will do the job, but use your own—not your significant other's good ones.

Usually, all you'll need to remove is the rim of the can. Then, very carefully, make parallel uniform cuts around the cut edge so that the excess material can be folded inside. I've found it helpful to make a ring of #14 or #16 solid wire to fit the inside diameter of the can. The ring is placed inside and the tabs are folded over it. This produces a reasonably smooth edge and helps fill in some of the gaps which might remain between the can and the magnet.

Next, drill the holes for the grommet, grounding bolt, and valve stem. I have found that a "step-drill" such as those made by Unibit™ is very helpful when working with thin flexible material like these cans. At this time, the area around the inside of the grounding-lug hole should be cleared of any lining

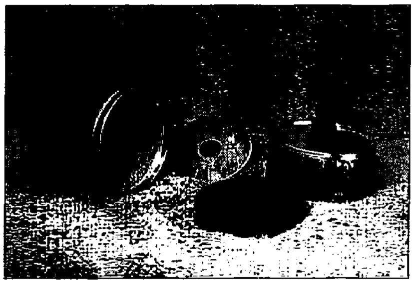


***Photo A.** Components of the Minnesota miser's magmount. (Photo by author.)*

material which might be present, to ensure a good connection with the coax braid.

If you want to paint the can to match your vehicle, now is the time to do so. I generally don't, since it makes the antenna look like an auto wart—with a hair growing out of it. If you decide to paint the can, make sure you rough up the outside with fine sand paper. Then wash it with soap and warm water, and rinse and dry thoroughly before attempting to paint.

Until now everything has been pretty straightforward, but here comes the interesting part. The problem encountered in the past has always been the base-to-radiating element insulator. A used tire valve stem makes a neat solution. It provides a strong, flexible mount with adequate insulation at mobile/portable power levels.

When collecting valve stems, get them complete with the valve core and the cap. Make sure the bottom flange has not been torn in the area where the assembly engages the hole in the can. Used valve stems are frequently available for the asking at tire sales and repair shops.

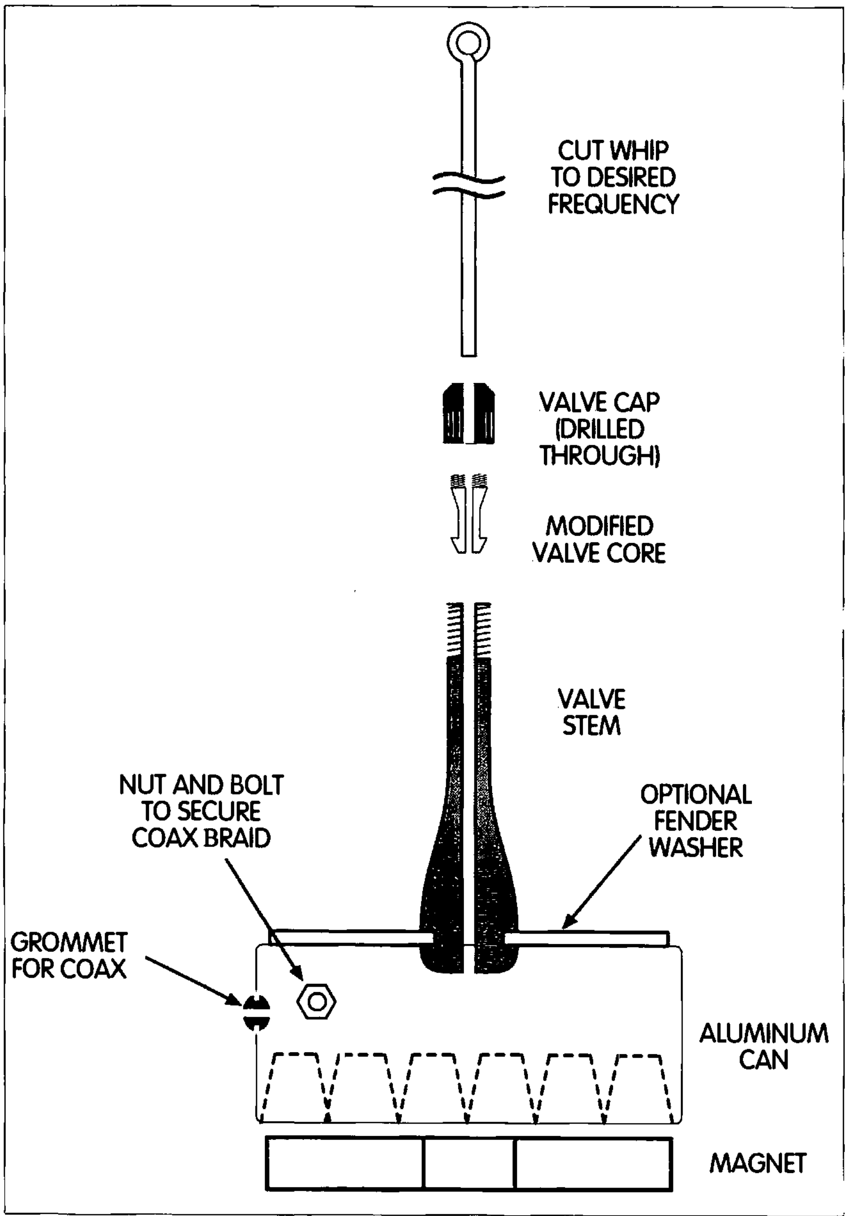


Fig. 1. Diagram of the magmount antenna.

The modifications necessary to make the valve stem assembly work in this application are minimal. First, drill a hole through the top of the cap to pass the wire you have chosen for the whip. Next, remove the valve core and nip off the brass top portion above the main part of the threads, being careful not to deform them. Then nip off just enough of the bottom to allow the internal parts to fall out. This should leave a threaded brass bushing with an inside diameter sufficient to pass the whip.

After installing the rubber parts and the grounding lug, select a piece of coax and install a connector to match your rig. The old rule for feedline length is: enough to reach from the antenna to the rig. For mobile installations, I prefer RG58 since it seems to survive repeated door slammings better than RG8-X, although the loss is a bit higher. But even at 440 MHz, a typical length of RG58 is only going to lose one dB in all. Using 9913 would cut that to about 0.27 dB but good luck if you try it on a mobile setup. Unless you drive an oil tanker to work.

If the top of the can you selected looks a little too floppy to suit you, install a suitably sized "fender" washer as shown in **Fig. 1.**

Installation of the whip comes next. I've used a number of materials in the past, including #14 house wire, aluminum rod salvaged from TV antennas, coat-hanger wire, and my favorite, copperclad-steel antenna wire. The house wire is okay but is so soft I spend a lot of time thinking I ought to straighten it. The aluminum is out for this application because it is hard to solder and the coat hanger won't do because the YL takes inventory too often. Ditto, the broadcast antenna from her car.

When making a quarter-wave whip for two meters, I like to start with about two feet of wire. I figure that if I start with a couple inches too much, I may waste that couple inches, but if I start with a bit less than enough, I've wasted all of it.

Slide one end of the whip through the valve core far enough to make it easy to solder it to the coax. Mark the

wire just above the top of the valve stem. Then slide the wire out and clean it so that it shows bright shiny metal from the mark to the bottom. Now, install the "modified" valve core and measure the distance from the top of the stem to the top of the core. It should be about 3/16-inch but may vary depending on how severely you modified the core. Place a second mark on the whip material 3/16-inch or whatever distance you came up with down from the first mark. Remove the core from the stem and slide it onto the whip to the second mark you made. Solder it in place, being careful not to slobber solder all over the outside or on the threads.

Now you can screw in the whip assembly and install the coax you measured earlier. Install the magnet temporarily and slide the whip through the hole in the valve cap. Now you're ready to trim the whip length for the lowest SWR at the desired frequency. When you start trimming the whip, remember that you don't have to take off much material to move the resonant point 100 kHz, and once you have cut it off, it is hard to put it back. That is why we install the magnet temporarily at this point.

Also remember that we do not want to leave the top end of the whip sharp and pointy. A pointed end on the whip will have more trouble with static discharge and is not as safe. Remember what Mom said: "You could put your eye out with that thing!"

I have tried a number of methods of blunting the top of the whip and the simplest I have found is to curl the top of the whip into a small "eye" and coat it with solder. Form the eye while the whip is still a bit too long, and then measure the SWR again. If the whip is still too long for the target frequency, keep curling. After you have made a few of these whips, you'll probably develop an eye for it and know when to stop cutting and start forming the eye.

Once you have the whip trimmed to the proper length, it is time to install the magnet permanently. If the magnet is a bit loose, wrap it with a strip of duct tape until it is a press-fit into the can. Then glue it into place. I prefer RTV cement because it withstands weather and vibration well.

Whether you decide to use the guidelines presented here or try a design of your own or build some other device, using something you have made yourself is always gratifying. 73, have fun, and keep your stick on the ice.

NEVER SAY DIE

continued from page 49

Psychometry

Is time travel just science fiction? Or is it not only possible, but available to anyone and usable for practical purposes? If you could travel into the future (and come back), how would you use the information you could glean? One obvious practical application would be to take a good look at a future newspaper, note where some stocks are then, and invest in the appropriate ones now.

Bevy Jaeger, in her book, *Psychometry*, explains how you can develop your ability to do just that. I found the book fascinating.

As I mentioned when I reviewed Owen Lehto's book, *Vibrations*, my grandfather taught me how to dowse when I was a kid. We lived on a small farm (150 acres) in northern New Hampshire with a fireplace and a wood stove in the kitchen being the only heat sources. No electricity. No running water. No indoor toilet, just a backhouse out in back of the hundred-something-year-old barn. Dowsing didn't make any scientific sense, but it worked.

We have an awful lot to learn about ourselves. About past lives and reincarnation. I've regressed dozens of people to past lives. It's easy, and everyone has 'em. About Heaven and Hell. About near death experiences (NDEs). About out of body experiences (OBEs). About remote viewing, which is real enough so our beloved government has spent millions using it.

About how we can communicate with plants and any other life forms. About how our own cells are in communication with us, even when separated by thousands of miles, or even in someone else's body as with an organ transplant or blood transfusion. About how twins raised apart have so many coincidences. About serendipity. About how we can make things happen that we want, as explained in the *Dilbert Future* book. About ghosts. About telepathy, psychokinesis, clairvoyance, and fortune telling. About angels, spirit guides, and where composers and writers get their inspiration from.

The no-brainer approach is to dismiss all this as hogwash. That's *The Skeptical Inquirer* and the *Scientific American* approach. But that's no more honest than the *National Enquirer* approach of accepting anything, and then grossly exaggerating it.

When I read Bevy's book I accepted her challenge, picked up a letter at random, held it in my left hand (that's the input hand for right handed people), and let anything at all come to mind. I immediately saw a huge waterfall. Hmm. I tried again and got smaller falls, but still waterfalls. Then I opened the letter and found it was from someone in Sioux Falls, SD.

Several of the books in my *Guide* to books you're crazy if you don't read have to do with similar subjects. This stuff isn't baloney—I've had too many personal experiences with it. We need to do more research and see if we can't tie everything together.

Getting back to Bevy and her book. She's helped solve many crimes with her psychic abilities. Her book explains how you can develop yours. And you *do* have them. If you are interested in seeing

what the future stock prices are going to be, Bevy explains how you can develop this ability. So why not try it and at first make pretend stock investments and see how much you would have made if you'd used money? Once you know what you are doing you'll be set to make all the money you want and spend some time helping me to make our country better.

The book is available from Aries Productions, Box 29396, Sappington MO 63126. It's $6, 119 pages, ISBN 9 100035-08. I'm not sure how much they charge for s/h. Buy several and give them to friends.

Lehto, in his book, explains how you can dowse almost anything you want. You can even find something on a map.

When I get some time I've got five other books that look interesting on divining that I've got to read.

Coincidence

I've been reading about the Great Pyramid again, and the more I read, the more questions arise. Was it by plan or just a coincidence that the Great Pyramid of Giza is located at exactly 30° North and 30° East? Is it a coincidence that the pyramid is built on one of the few (or only) flat granite foundations in the world which could support its enormous weight? Is it a coincidence that it is located at the exact center of all the land masses of the Earth? Is it a coincidence that the sides face exactly north, south, east and west? Is it a coincidence that the measurements of the pyramid embody logarithms to the base e? That another measurement shows the distance in light years to the North Star at the time the pyramid was built? That the concave sides of the pyramid are the exact same arc as the curvature of the Earth?

And so it goes. The more you read, the more the coincidences pile up! How old is it? The estimates range from 4600 years ago to 12,500. With all of our high technology and massive equipment today we could not duplicate the Great Pyramid. Yes, it was supposedly built before the invention of the wheel. The massive blocks were cut to watchmakers' tolerances and put exactly into place. Millions of them. A tomb for the pharaoh? So why was he buried hundreds of miles away?

The periphery of the pyramid, divided by twice its height is equal to *pi*, to several decimal places. And this was thousands of years before geometry was developed. The periphery in Jewish inches is 36,524. By coincidence there are 365.24 days in a solar year. It gets worse, the four sides are of slightly different lengths, with the number of inches varying exactly by the lengths of the four seasons.

The average height of all of the land on Earth is 5,449 inches. By coincidence (naturally), this is the exact height of the pyramid.

The coincidences go on. Get a book or two on the subject and see for yourself. This is a lot more interesting to talk about on the air than what rig you decided to buy.

A New Paradigm

Most of us old-timers in amateur radio are living in the past and are doing our best to ignore the realities of the 1990s. Since I first started making 40 meter CW contacts and phone on 160 meters with a 6L6 crystal oscillator modulated by another 6L6 60 years ago, I qualify as an old-timer, so I can speak with some authority.

I spent years at my workbench building ham, audio and other electronic equipment. My cellar was filled with enough parts so I could build just about anything. When I moved to New Hampshire from Brooklyn in 1962 it took four vanloads to move me.

But, as I saw the changes transistors were making, I held a huge auction of my stuff in 1965 and almost gave away tons of surplus equipment and parts. Big boxes of tubes for a buck. Thousands of tubes. I wanted to find good homes for my collection.

So here we are, coming to the end of the 1990s, and the world is so changed from the one I knew in the '30s, '40s, and '50s, that it really is a different world. That was back when we had over 850 ham radio stores around the country; back when American companies were the major manufacturers of ham gear—Hallicrafters, National, Hammarlund, Gonset, Barker & Williamson, Technical Material, Harvey Wells, Multi-Elmac, Thordarson, Stancor, Bud, Millen, Eico and Heathkits, and so on. It was when I could go downtown to Cortlandt Street, in New York, and shop at dozens of radio stores for parts. It was when the Allied Radio catalog was like a telephone book.

Today we have around a hundred ham dealers and no parts houses like we had in the old days.

But then it was not just possible, but *practical* to build your own stuff. Oh, hams stopped building receivers soon after the first commercial ham receivers were made available, but we still built our own rigs, our VHF equipment, RTTY, and so on—and we had a ball doing it. I spent so much time at my workbench that eventually I'd twisted my pelvis by standing most of the time on one foot. A chiropractor showed me the X-rays.

Once Japan took over our consumer electronics industry we no longer made parts in America. Gone were the bargain surplus parts from manufacturing overruns. Companies ordered more parts than they needed because it was cheaper to sell off or throw away the overage than to not have enough parts for a production run of equipment.

As ICs replaced discrete parts, even the parts stores in the Akihabara section of Tokyo (their version of our old Cortlandt Street), gradually blew away.

Today's reality is that most commercial equipment uses as many ICs as possible, with a minimum of discrete parts. This makes it almost impossible for us hams to either modify or service the stuff. When it stops working we have to send it to the factory service department. And rolling our own, unless it comes in kit form, is getting less and less practical.

Yes, it was fun building. I loved it. But that was another era. Yes, it was great when we could fix our equipment when it broke. But that's impractical now.

In the days when we designed and built our own stuff it was important for us to learn radio and electronic theory. You fixed a receiver by having the right test equipment and the know-how to signal trace. Now you put it back in the box and let UPS handle the problem.

When my HT stops working I don't take it to my workbench where I have a bunch of test equipment. Heck, all of my test gear was stolen years ago by past *73* editors and I've seen no good reason to replace it. Tube testers? Har-de-har. Transistor testers? They don't use many transistors any more. A signal generator? How'm I going to trace anything in that tiny rig?

So why are we asking theory questions on the ham exams? Because we always have. Why are we still testing for Morse Code? Because we always have. So we have us old-timers living in a world that's only left in our minds. And we have the new generation, grumblingly memorizing the Q&As to pass our ham tests, which are a relic of long gone days. By not being interested in upgrading, even to General, they're telling us loud and clear that it's time for the old-timers to rethink what this hobby is all about. But getting the average old-timer to think is a challenge that I have been successfully failing at for years.

The newcomers already outnumber us old-timers, but unfortunately they have no national organization to help them express their interests or bring them together. So, for

the foreseeable future the Old World Order and the Balderberg group will keep patching the Great Wall of CW to keep the infidels from polluting our HF bands.

When the microcomputer revolution started it was fueled by thousands of hobbyists who were building their own personal computers, led by *Byte*. Take a look at today's shriveled issues of *Byte* and see for yourself that people, and youngsters in particular, are no longer technically inclined.

In the ham hobby the newcomers are refusing to join the ARRL by the hundreds of thousands. Computer hobbyists today want to use computers, not design and build them. Hams today want to use ham gear, not design and build it. The ARRL directors, all being old-timers, have been hard-nosed about maintaining our traditions, no matter how out of date with reality. So, instead of our having five to 10 million hams we have maybe a couple hundred thousand even remotely active. And just about zero clout. And that'll only be a problem if another service comes along that wants our frequencies, or if the new FCC Commissioners wise up.

Class of '38

Whew! With the help of a lot of luck and some good living choices I've managed to be active in amateur radio for 60 years. My first contacts were back in 1938 on 40 meters, back when everyone was crystal-controlled. And on 160 m with a 6L6 crystal oscillator modulated by a 6L6, driven with a carbon mike.

160 was a ball, with groups of three to six of us all working duplex. It was just like sitting in a room with everyone. By 1940 the FCC had outlawed that kind of nonsense.

I was living in Brooklyn at the time and had a map with every ham in Brooklyn marked on it. I visited many of them, a kid on roller skates. I remember Stan W2ET, who, even though blind, built all of his own equipment.

In 1941, just before World War II broke out, I won the Eastern New York section in the ARRL's Sweepstakes Contest. Wow! The next thing I knew Pearl Harbor had been attacked and we were all off the air for four years.

In 1942 I joined the Navy as a Radio Technician 3/c and went through their electronic schools in Maryland, San Francisco, and Pearl Harbor. As an Electronic Technician 1/c I was assigned to the Drum SS-228 in 1943 and made five war patrols. From there, in 1945, I taught school at the Submarine Base in New London until my discharge in 1946.

I was on the air on December 7th, 1941 and back on again the day the FCC again opened the bands in 1945, using the 2-1/2 m transceiver I'd built in 1939.

It was my ham ticket that paved my way into the Navy and it has guided most of my life ever since.

Go Navy

A note from K6DC asks me, as an old Navy man, to have you check out the NSS Web site at [http//www.members.aol.xom/k6dc/nss.html].

Merle says that Don Stoner W6TNS/4 is poking the keys for the project, since he was at NSS during WWII with his mom and dad (K6HX). Check it out, you old swabbies.

IRS Collapse?

Will the "Millennium Bug" destroy the IRS? That's the year 2000, which older computers will be unable to handle. It'll look like 1900 to them.

Last year the IRS's chief information officer Arthur Gross admitted to Congress that its $4 billion, 11-year attempt to modernize its computer system had failed. They have 63 aging mainframe systems and I don't think they even can guess how many microcomputers. They have a staff of 7,500 just involved in computer maintenance, and $1 billion a year for that budget.

Their whole information system is apparently a terrible mess, with many systems unable to communicate with others. The old mainframe systems have as high as 30% of their software written in assembler language, which few programmers today even understand. That's just one step above machine language! Will the IRS be able to fix 62 million lines of "noncompliant" code by June 1999, thus allowing their systems not to crash as the Millennium Bug hits? But there are some little problems—like missing code records in the field offices and missing manuals everywhere. Their system is spread out in three major computing centers, with 60 of the mainframes in 10 regional field offices—and none of the mainframes yet programmed to deal with the year 2000.

What can they do? There aren't enough assembly language programmers left in the world to update their present antiquated systems, even if they had the documentation needed to help them put in the patches. And there surely isn't enough time to start over from scratch.

Apparently they've been adding one patch after another as problems have arisen. But due to the complexity of the system, these patches have, lacking the manpower and time, been implemented without being tested, and that's led to more and more bugs in the system.

So today the IRS has a hopelessly outdated system which is near collapse and seemingly unfixable. Then, to cap it, the year 2000 mess is inexorably approaching.

Maybe it's almost time for Congress to get serious about a flat tax and retirement for the IRS staff. With unemployment at record lows, we might be able to find work for them in the private sector.

What will happen if on July 1, 1999, when the fiscal year 2000 starts, the IRS computers grind to a halt? When the revenues suddenly stop, what's going to happen to T-bills and T-bonds which banks and money markets have trillions invested in? Our whole financial system is a house of cards anyway, so something like this could topple everything, suddenly making our dollar bills worthless. The ugly new hundreds, too.

If you don't understand the flimsiness of the Western banking system you need to read chapter III of *The Delicate Balance* by John Zajac. It's only $15 from John at (408) 226-0750. Wayne sent you.

It'll be interesting to see what happens. Stay tuned.

Our Ham Megapublisher

The League sent me an ad for their *1998 Handbook*. Now, I knew the ARRL had a bunch of publications, but until I looked over the list they sent with the *Handbook* promotion, I hadn't realized the extent that publishing is the League's main business. I counted 92 ARRL publications on their order blank. Plus a bunch of cassettes, videos and CD-ROMs. As they say, if you want to know what's going on, just follow the money. The League may be masquerading as a membership organization, but the reality is that they are a giant publishing company. That's where the money is, and that's where their interests lie. Now shut up and re-elect your old director.

Those Pesky EMFs

Did you get sucked in by the National Cancer Institute stories claiming that there was no evidence that power line electromagnetic fields increase childhood leukemia risks? A couple of *73* readers "proved Wayne wrong" by sending me newspaper clippings on the NCI releases. If the reporters had read the fine print in the NCI report they'd have found four places where it was admitted that there was a statistical increase in acute lymphoblastic leukemia in children exposed to power line magnetic fields in excess of three milligauss. Researchers dismissed as a

fluke a 24% increase in leukemia risk for children exposed to high magnetic fields.

The leading researcher in the field is Professor Ross Adey K6UI, who is the author of many papers and books on the subject. It must be extremely frustrating to Ross to see these NCI distortions getting such media coverage.

As Ross has pointed out, our cells are electrical and any stray magnetic fields tend to disturb the communications between cells and in their replication. Whenever you pass a magnetic field through a conductor it generates a voltage, so it's no wonder that 60 Hz fields can increase leukemia in children, whose cells are growing and expanding at a high rate.

Those Pesky Vaccinations

For any readers who think I got carried away by the Walene James book on the dangers of immunization, there's a six-page article in the Oct-Nov issue of *Nexus* magazine confirming these dangers and backing up James' reports of her research. I was offered a flu shot the other day. No thanks! I prefer to eat right and keep my immune system strong so it can reject colds and the flu.

Lasers

Unless you've insulated yourself from the real world, you've been reading about the use of lasers for communications. They're wide-band enough to be capable of handling 100 TV channels. It would take about a half second to send a complete encyclopedia via a laser.

Some years ago, when I was having fun on 10 GHz, I proposed using the simple transceivers we can make for that band for repeater links and control. That would free up big chunks of the 450 MHz band. With the directivity of dishes, almost every repeater in Southern California could be controlled on the same channel without any interference.

But now, with lasers, those could be used for repeater control and monitoring. Or are we going to continue to stay 20 years behind the current technology? Well, I suppose that's better than staying 80 years behind with CW.

More Moon Madness

René's book, *NASA Mooned America*, in which he claimed that the Moon landings never happened, either is wrong or we've all been had by the greatest hoax in history. A $40 billion hoax.

René gave 30 compelling scientific reasons why he doesn't believe that man has yet visited the Moon. I mentioned in an earlier editorial that, lacking moisture, the dust on the Moon should not have shown the clear footprints and Rover tire tracks. Several readers jumped on this, claiming that even very dry dust of some kinds can hold footprints. Hmmm, maybe.

Now I've learned that Fred Whipple of the Smithsonian, as cited in *Exploration of the Moon* by Branley, said that dust particles would become tightly packed together without gases to filter in between and separate them. An experiment to verify this was done by Dwain Bowen of North American Aviation. He released a steel ball into a container of fine dust, where it promptly sank. When the same ball was dropped into the same dust, but in a near vacuum, the dust had formed a hard crust that stopped the ball at the surface. Thus, either all of the photos showing footprints and tire tracks on the Moon were faked or else there had to be an atmosphere there. No mention has ever been made of our astronauts discovering any atmosphere on the Moon.

Indeed, with the Moon supposedly having one-sixth of Earth's gravity, any atmosphere would have soon been dispersed into space.

So, could the Moon actually have more gravity so it could hold air? Calculations for the mass of the Moon, using its path around the Earth and the Sun, give us an accurate estimate of its mass. And, unless Newton was wrong, this also tells us how much gravity it should have.

William Brian, in *Moongate*, raises questions on this. He points out that the neutral point, where a space ship would change from the Earth's gravitational attraction to that of the Moon, has been calculated to be from 22,000 to 25,000 miles from the Moon, depending on its distance from the Earth at the moment. The average is 23,900 miles. This figure was published in a number of reference books, including the *Encyclopedia Britannica*'s 1960 edition.

Now we go to a 1969 book by Werner Von Braun, who sure ought to know, in which he gives the neutral point as being 43,495 miles from the Moon. The 1973 *Britannica* gives us 39,000 miles. Now, for these figures to be correct, the Moon's gravity would have to be 64% that of Earth instead of 17%. What's going on here? Even if the Moon were made of solid lead it wouldn't have that much mass.

Brian has analyzed the data on the speeds and times NASA has released of the Apollo craft and the numbers are so far out of whack that they just don't make any sense.

It gets worse. If the Moon does have the gravity which would put the neutral point at 39,000 miles, then our space capsules would have to carry more fuel in order to slow down to land. The amount of fuel required and the tanks to hold it would be almost as large as the entire rocket used in the Apollo launches, doubling its size. So obviously that didn't happen.

If the Moon's gravity is 1/6th that of Earth the astronauts should have been able to jump seven feet in the air, even in those bulky suits. Their best jumps were about a foot. Just like on Earth. Which suggests that either the Moon's gravity is close to that of Earth or else they weren't there. Brian looked over the films of their Moon walks and noticed that one had to help the other get back up when he stumbled, and that they all got tired climbing even low hills. Heck, they should have been bounding around like kangaroos and hoisting themselves up the ladder to the LEM with their arms. Which they didn't.

Photos with the Sun in the background showed the sky lit up like it is here on Earth. If there is no atmosphere in the Moon, there should have been nothing to light up the sky.

It comes down to: The photos from the "Moon" either were taken on a Moon with about Earth's gravity and air, or they were faked here on Earth. If it does have that much gravity, then where's the missing mass needed? Or do we have to throw out Newton's laws?

I am now convinced that when President Kennedy said we'd send a man to the Moon and got Congress to budget for it, that when NASA found that the mission was impossible with the technology at their command, they were faced with either losing about $40 billion and probably NASA, or faking it. I further believe that NASA, probably with the help of the CIA, had to manage a string of murders (as detailed in René's book) of potential whistle-blowers to keep the hoax a secret.

Juke Boxes

When I was a kid juke boxes had a stack of 78 rpm records in 'em. Nowadays it's CDs and a capability for storing 500 songs. The next step shouldn't be a big surprise—juke boxes with the recordings all in memory which is updated via a telephone.

When I was in college I'd buy 78s which had been used in juke boxes for a dime each. One side of the more popular records was well worn, but the other was brand new. I have a 1940 picture of my mother in front of Sam Goody's store on Cortlandt Street in NYC, where he sold used juke box records for a dime. Sam obviously did well.

Continued on page 86

The Official 1997 "Never Say Die" Index

A three-volume reprint of Wayne's editorials, in large type, is available from Radio Bookshop for $15.

Volume I:
January 1997
Resolution — Resolve now to make major changes in your life.
The Camel's Nose — Congress smells money selling our bands.
ARRL Worried — But has no plans other than to ask for money.
The Michigan Miracle — State budget is balanced, debt retired.
Those pesky ETs — Have they been visiting for millennia?
Rejuvenation — An update on the magic of the Bioelectrifier.
Cesspool — 14.313 is still garbage. ARRL doing nothing.
Professors and Beards — Do beards go with low self-esteem?
Vegetizing — Wayne's coleslaw dressing recipe.
Government Control — Forcing your beliefs on everyone.
Oxygen — How to cope with the decreasing oxygen supply.
The Value of College — Putting college costs into perspective.
Schools — Costs are way up and education is way, way down.
Magnetic Healing — We sure have a lot to learn about this!
Bioelectrification — Done with two dimes and a 27V battery.

February 1997
"The Weather Here ... " — A plea for better radio conversation.
The Dennis Lee Debacle — *Caveat emptor!*
Grist — Two collections of my editorials.
Boilerplate — 43 of my ham-oriented editorials in a $5 reprint.
Shocking — Electric fence jolt cures virus!
Memorial — What are you contributing to the world?
Congratulations! — The gov't is now taking 50.4% of your pay.
Justice — Our so-called criminal justice and correctional system.
AIDS, HIV, and Other Baloney — Let's face the truth.
Dr. Fisher Disagrees — But not a whole lot.
Scientists — They play the prestige game, but make little money.
Fluorides, Again — Report available showing genetic damage.
Do It Yourself! — It's time to sit down and write.
Placebos — Powerful medicine if we learn how to use 'em.
What Is the Truth? — Weird things are happening.
Day Care — What kids should be learning, not what they are.
Portable Classrooms — Bringing education to the kids.
Arrested! — Yes, your ARES card can get you arrested!
Nondisclosure Agreement — Another product you can make.
Okay, Gadgeteers — Get busy and make a million.
Selling Music — Selling ethnic music to restaurants.

March 1997
Schools Finally Reinvented — The Sudbury Valley School.
Mooned Again — Were the Apollo trips a $40 billion hoax?
Scientist Welfare — The supercollider, hot fusion, HAARP, etc.
Pork Chop Hill — More examples of congressional pork.
Superhuman — Let's study people with unusual abilities.
Virus! — How can a virus travel via UV light?
DX News — Working it, and visiting DX hams.
Bum Tubes — Look for a tube tester at flea markets.
Death Sentence or Wake Up Call? — Cancer.
Money Is the Root — "Money is our downfall."
NOYB — Excising your personal data from Lexis-Nexis records.
Star Trek™ Nonsense — Galactic battles? Ridiculous!
The Fat Life — 34% of us are clinically obese and will die early.
Hamfests — They're dying. Here's how to improve them.
Speed — CW and packet are years behind current technology.
Half Our Population — We should have five million hams.
Intruders — Hams selling ham band gear for commercial use.

April 1997
The Handwriting — The disappearance of HF ham operators.
More Bio-E News — More miracles have been reported.
The Freon™ Hoax — Did DuPont™ dupe us all on this one?
School Costs — Cut 'em in half and improve the product.
Building Skills — My list of skills it's advantageous to build.
von Däniken Again! — The pyramids made out of concrete?
Weird Forces — How the "pyramid effect" was discovered.
Another Gloom and Doomer — Countering rising CO_2 levels.
The Federalist Papers — Weakness = subjugation, not peace.

Sharks! — Can shark cartilage really help cure cancer?
ZL Media Flurry — Media ado when ZL youngsters placed 14th.
Self-Abusers — Smokers and alcoholics make lousy employees.
State of the Art — We need to sell kids on amateur radio.
Parenting — Is not intuitive. Read or screw up your kids.
Wayne's "Been-There-Done-That" list.

Volume II:
May 1997
220 Pffft? — Will we lose the rest of the band to the LEOs?
East vs. West — American ham license growth vs. the Japanese. Ugh!
Bad Apples — K3ZO wins an award for rude behavior.
The Code Again — The code prevented DeForest from getting a ham ticket.
Our Story — Let's get ham stories into the newspapers and on TV. Or else.
Talk Radio — The Art Bell W6OBB show - coast to coast. Wow!
Hey! Wake Up! — Are you still commuting to work? Yuk.
Cancer — Half of you will get it unless you change your wicked ways.
Screw The Generals — Like General Motors™ and General Foods™.
Shortchanged — Our country is run by the crooks. Am I exaggerating?
Wayne Disappeared? — If I keep making waves it could well happen.
The Magic Bullet — In praise of the Bioelectrifier. Build one.

June 1997
Bio News — More praise for the Bioelectrifier. Built one yet?
Pirating — Another business opportunity for the motivated.
FCC Swat Teams — Indecent talk is now illegal! Calling all lawyers.
Positive Action — A better approach to the LEO problem.
Conspiracy — Unless you make a fuss we're going to get screwed. Again.
CC&R — Watch out for the fine print!
Red-Green — Foods fall into two groups. Are you eating the wrong one?
Flight 800 — It started late. Guess what plane was supposed to be there?
Ear Plugs — Yes, I should shut up and stop trying to motivate you.
Revolution! — Wherein I again try to motivate you. And probably fail.
Good PR — A few clubs get stuff into the papers. Too few.
It's Too Late — You've graduated college so your education is complete.
Secrets — Actually, the gov't is pretty good at keeping 'em.
Fried Brains — Scientist proves cell damage. Permanent damage.
Diehards — Cold fusion update, and why it's working so well.

July 1997
What More Can I Say About Hamfests? — They're dying.
NASA Confirms Cold Fusion Excess Heat! — And it only took eight years.
Nut Case — I plead guilty to being a bona fide nut. With an explanation.
Quid Pro Quo — Welcome to Glen Baxter K1MAN's empire (in his mind).
Xtal Sets — They're easy to build; great stuff for kids.
Oh Oh Ozoned — Yes, we've been suckered again. Big surprise.
Tandy Shakeup — Have they finally canned president Roach?
The Last *Callbook*! — Yup, it'll just be on CD from now on.
Business Incubation — How to successfully start new small businesses.
Clubbing Us — Ham club president idiocies.
Mooned Again — We're still looking for ETs in the wrong places.
The Ham Impact — Tell me about *your* adventures.
Those ARRL Proposals — Rearranging the deck chairs on the Titanic.
Books For Crooks — A new kind of prison library proposed.
Guts — One person can make a big difference ... but only if he tries.
Distant Learning — Using books and videos.
Another War Lost — The wars on drugs, poverty, cancer have been lost.

August 1997:
Milestone — My 75th birthday! But most of my close calls were ham-related.
To Recap — How *73* got started. Well, it seemed like a good idea.
Sucker — Are you fat, dumb and unhappy? Most of us are.
Books — Radio Bookshop, *CQ Magazine*, and the book biz.
Viva CW — The slowest way to communicate.
Vanity, Vanity — Why I'm still portable 1 after 35 years.
Six Flags™ — The game park was great; the amusement park was a bomb.
Avoiding Shots — You don't have to let 'em poison your kids.
Water — Are you still drinking city or town water? Forsooth!
FCC News — Much easier reciprocal operating a-coming.
Liar Liar — Bribery is impeachable. Art. II, Section 4: the Constitution.
Boiled Silver — An update on making colloidal silver.
DVD — Those pesky new digital video disks.
My goals: Make hamming more fun, help you be healthier and happier.

Volume III:
September 1997
Happy Birthday *73!* — Wherein we start our 38th year of publishing.
Medical Update — Why the Bioelectrifier is being ignored by doctors.
Our Oblate Spheroid — Can the poles suddenly shift to the tropics?
Basics — Here's a recommended electronics fundamentals book.
Antiques — Breaking loose from the FCC straightjacket.
Webbing It — We're going to start listing Web sites of interest.
The FDA — How the FDA crushed a doctor with a proven cancer cure.
Shooting Kids — More proof of the immunization scam.
Making Your Hobby Pay — Writing articles for *73* can pay off!

Gutted!— More unnecessary surgery. There's a better way.
While I'm at It — You really do need to get UVs into your eyeballs.
Snowballs From Heaven — Some as big as a house are hitting the Earth.
Those Moon Rocks — Did they really come from Antarctica?
Baloney! — If you disagree with me, have you done your homework?
Dim Bulb — Can the light of reason prevail? Not likely.
Crop Circles — Weird, and there's no known way for us to make 'em.
Call Me Stinky — What poisons are you putting on your skin?
Your Tax Dollars At Work — Funding tyrants. The new Haitian mess.
New Hams — Yep, 95% of the new hams are Techs.
Laughing All The Way — Another good weapon against that killer stress.
DVD — Digital video disks hold nine times more data.
Pesticides — They're only needed for sick crops. Wash 'em off!
Autism — Caused by DPT shots.
Reinventing Hamfests — Hamfests are slowly dying — new ideas needed.
Commercial Exhibitors — Coddle them. Give them a forum.
Speakers — How to get speakers who will draw crowds.
Hamfest Committees — How to build attendance at hamfests.
Food — Have good food available. Beer is a bad idea.
Those Suffering Wives — They need more entertainment at hamfests.
Bringing In The Techs — It's going to take a special effort to get 'em.
Cleaning Up — Sneaky way to clean up our foul-mouthed hams.

October 1997
Addiction — The cigarette addiction is one of the worst.
Get Off Your Duff — And start writing articles.
Why Doctors Are So Bad — They're prisoners of a lousy system.
Those Darned Fluorides Again — They're killing 60,000 of us a year!
Change — Leaders embrace change; the sheep hate it.
Can 200 million Americans Be Wrong? — They may be right about UFOs.
Murdering Millions — Winding up the bloodiest century in history.
Those Pesky Crop Circles — Can they be the plans for a spaceship?
Crash — By 2012 we'll have 0% General Class Licensees.
Hamfest Report — Dennis WB8QWL's proposals to revive 'em.
Covering It All Up — Technology breakthroughs from Roswell crash.
Gold Brick Or Lead balloon? — Throwing away the key to success.
Science, Hard and Soft — The two are merging, confusing scientists.
Timing… …is everything, and my timing has been very good.
Viva Dilbert! — Scott Adams' new book has a serious, practical side.
HIV Update — The Bioelectrifier seems able to do almost anything!

November 1997
The End Is Near! — New Year's Resolution: Try something new.
Take the Express — The secret of success is unveiled.
Medical Science? — Like all sciences, it rejects new ideas.
Smoking — If you're still smoking, don't read this.
Music Soothes — Stress kills … good music is a good antidote.
Educating Our Own Children — Sure it takes time, but it's worth it!
Paying For Preschool — An innovative proposal.
Mea Culpa — We get too soon old and too late smart.
Magnets — Some magnetic healing miracles.
Forgetting Things — The mercury and Alzheimer's connection.
Health Tompoopery — Whom can you trust? It sure ain't easy!
The Deficit — P.J. O'Rourke solves the deficit problem.
Budget Baloney — The latest agreement is just another con game.
Our Unconstitutional Congress — Roosevelt opened the pork barrel.
An AIDS Vaccine? — Billions more wasted on drug company welfare?
Even More Medical Mischief — The *Penthouse*-reported cancer cure.
A Head of My Time — Snap-on skates for city use invented!
Another Excuse — More info on smoking and birth defects.
Space Radiation — It's a killer beyond the Van Allen Belt.
The Bright Side — The Web will relieve pressures on our HF bands.
Industry Blindness — The power companies don't want to know.
Elemental Energy — A new name for the cold fusion phenomenon.
Faster! Faster! — How we can triple data transfer.

December 1997
The Magnetic Motor — Wayne rides the Takahashi scooter.
Big Brother — Jammer needed for automatic speed traps.
Skip This — Princeton's psychic experiments.
The Ice Caps Are Melting! — Oh, baloney!
Biocommunications — Is there an instantaneous wideband medium?
QRM Reduction — Stiffer FCC tests to weed out lazy hams.
Runny Noses — Airborne microbes and viruses abound.
OK Conspiracy? — Fertilizer bombs really, really stink.
Jobs — The job market is changing. You'd better, too.
Birth Defects — 99.9% are invisible, but they're sure there.
Takes All Kinds — The beach-ball repeater jammer.
Paparazzi — Condemning the tabloid buyers.
Kids — Whew, we sure need 'em as hams.
L-Fields — Fields of life you can measure and use.
Doctors — Putting 'em into perspective. We need 'em.
Roswell — A high Pentagon official spills the beans.
The UPS Strike — Factors you may have missed.
Heritage — What crap are you feeding your kids?
A Roaming ROM — ARRL put repeaters on a ROM.

Tear Apart Your Tube Supply
continued from page 36

wired OK, replace the fuse, take a deep breath, and flip the switch. You'll know in an instant if all is well. The pilot lamps will glow and the filaments will come to life. It's a great feeling when a job's well done and your gear is on line. By your efforts, you've contributed to keeping the vintage equipment running and performing right up there with the newer rigs on the block.

Parts suppliers

All Electronics
905 S. Vermont Avenue
Los Angeles CA 90006
(800) 826-5432
Capacitors: Nichicon 470 µF @ 450 VDC, catalog #EC-4745
Rectifier diodes: 1N5408, 1000 V @ 3 A

Antique Radio Supply
6221 S. Maple Avenue
Tempe AZ 85283
(800) 706-6789
Phenolic twist-mount can insulators: #SH-120

Letter from Down East
continued from page 64

signal reports. QSB is beginning to take hold as he finally comes to the last station ahead of you. You listen to him acknowledge that station and give a signal report. Then that station comes back. He starts out with a song and dance about how his wife's sister's neighbor has a daughter living in a town near by and is he familiar with the town and has he ever heard of Whatchamacallet's daughter. QSB is getting worse and it takes five or six minutes just to exchange this information. Then, as if that were not enough, he wants to know what the weather is like and what equipment he is using and goes on to describe *his* weather and his equipment in minute detail. Finally, he signs and you hear the beginning of your callsign just as the QSB finally bites. You're right … you never did get to confirm the contact.

This is just not fair. I would like to propose a rule that says anytime someone hogs a rare DX station, his callsign should be sent in to the authorities in charge of awards, and he/she should have 10 DX contacts deducted from their list of DXCC. A second offense calls for a deduction of 25 DX contacts from the list and a third offense calls for a six-month restriction to using only two meters. 73, Hal.

NEVER SAY DIE
continued from page 82

Finish Your Spinach

I see in *Business Week*, p.106E36, 11/10/97, that "most major health organizations recommend eating five to eight servings of fruits and vegetables every day." Well, I'm glad I'm not alone in preaching this gospel. The article goes on to point out that, "These foods contain not only basic nutrients but also disease-fighting compounds known as phytochemicals, many of which can help ward off cancer, heart disease, and diabetes."

So much for a cold cereal, white toast and coffee breakfast. Or coffee and Danish.

Dr. Douglass of *Second Opinion*, in whom I have a good deal of confidence, says we should be eating three apples a day and two bananas.

How about you, oh sinner? Are you eating your vegetables? Or are you determined to head for an expensive hospital stay and plenty of medical care and drugs before you die several years before your otherwise time?

Frozen veggies are okay, but not as good as raw. Canned veggies just don't count. If it comes in a box or a can, it's probable that it isn't good for you.

Nursing Homes

You probably missed the *Time* report on Nursing Homes in their Oct. 27th issue. Since over half of you are headed for one unless you make some major changes in your lifestyle, you'd better read that report and see what you're going to be getting into. Will this be enough to keep you out of McDonald's®, Pizza Hut® and Dunkin' Donuts®? I doubt it. Your mouth is gradually going to make you a dribbling, hobbling, veggie.

Your body needs raw fruit and vegetables, sunlight, lots of distilled water, exercise, the vitamins, minerals and enzymes missing in today's food supply, and a freedom from being poisoned. You are not likely to get any of these in a nursing home or convalescent hospital, so what you are going to do is get sicker and die, like everyone else there. And it's going to be horrendously expensive.

One study of California nursing homes showed that more than 7% of the people who died were victims of utter neglect—a lack of food or water, untreated bedsores, and so on.

You are making your own choice on your future with your present lifestyle. But, of course, like smokers, you are helpless to make the needed changes, no matter how terrible the consequences and the suffering you'll endure eventually.

Hey, I love the taste of pizza and fried chicken. I love doughnuts and Danish, a juicy steak, barbecue and premium ice cream. But the tradeoff is sickness and a shorter, much more painful life. Your choice.

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

Encouraging signs of activity on the sun are becoming more frequent as this is written (November 1997), and the solar flux has recently hovered in the 80–90 range, 40 percent better than what we've seen for the past few years ... so take heart, DXers, things are on the way up. But don't expect miracles, as DX conditions in winter near the bottom of a sunspot cycle are never great, and they tax your operating skills to the limit.

You can expect the first and last weeks of the month to provide seasonally Good (G) conditions and the middle two weeks seasonally Fair (F) conditions on the HF bands. See the accompanying calendar and band-by-band charts to pick and choose your times and bands for operating.

The days between the 19th and 22nd are likely to exhibit Poor (P) operating conditions due to an ionospheric disturbance which will increase signal absorption and produce weak and watery sounding signals on normally decent DX paths, particularly those closer to the north and south poles.

10–12 meters

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

15–17 meters

DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the US.

20 meters

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

30–40 meters

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

FEBRUARY 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
1 F-G	2 G	3 G	4 G	5 G	6 G	7 G-F
8 F	9 F	10 F	11 F-G	12 G	13 G-F	14 F
15 F-G	16 G	17 G	18 G-F	19 F-P	20 P	21 P
22 P-F	23 F-G	24 G	25 G	26 G	27 G	28 G

80 meters

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar), and also short-skip during hours of darkness to 1,500 miles or more.

160 meters

This band ought to begin to come alive again during the hours of darkness when QRN permits. Try the days marked (G) on the calendar for best results. DX toward the east until midnight, and to other areas afterwards, until dawn. Short-skip to 1,500 miles will prevail when the band is quiet.

Remember to let me know how these forecasts are working for you. Your feedback is much appreciated. W1XU.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	14	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

ALASKA	14	14	14	7	7	7	7	7	7	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	7	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	14	14	14	14	14

WESTERN UNITED STATES TO:

ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	14	7	7	7	14	21	21	21	21
AUSTRALIA	21	14	14	14	7	7	7	7	7	7	14	21
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	7	14	14	14	14
HAWAII	21	14	14	14	7	7	7	7	14	14	21	21
INDIA	14	14	14	7	7	7	7	7	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	14	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	7	14	14	14	14	14
EAST COAST	14	14	14	7	7	7	7	14	14	14	14	14

Including Ham Radio Fun!

73 Amateur Radio Today

MARCH 1998
ISSUE #450
USA $3.95
CANADA $4.95

International Edition

Antennas:

Stealth

Portable

20-40m Loop

MM Adventures

ATV Rocketry

Reviews:

Comm Spec's ID-8

MFJ-224 2m Analyzer

Test Equipment You Can Build

THE TEAM

El Supremo & Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
J. Clayton Burnett
Priscilla Gauvin
Joyce Sawtelle

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Jack Heller KB7NO
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister W5ACM
Dave Miller NZ9E
Joe Moell KØOV
Steve Nowak KE8YN/5
Carole Perry WB2MGP

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

MARCH 1998
ISSUE #450

73® Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

REVIEWS

HAM RADIO FUN SECTION

On the cover: Fern Lamoureux VE2FSP's *Robin Hood*, sporting a folding dipole for 20-15-10m, was captured in Kingston, Ontario, by N4UAU while on his St. Lawrence Seaway odyssey (page 10). We'll be happy to pay for your cover photo—no matter where it's from—so get busy and start shooting!

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine. No part of this publication may be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

NEVER SAY DIE

Wayne Green W2NSD/1

Exciting Times

It's difficult to write a New Year's piece in November, so you'll get this along in February or March and have to make do. As of 1/1/98, none of the doom-and-gloommeisters' catastrophe predictions had yet materialized, leaving me with little but a bunch of exciting things to think about for the new year. There's so much going on that I don't know what to write about next.

You already know, I hope, that cold fusion is getting warmer. When it started out with the Pons and Fleischmann announcement in 1989 that they'd been able to generate excess heat using palladium and a simple electrolyte, both physicists and chemists snorted that it was impossible. There was no theory to explain it, so P&F had to have made some sort of stupid mistake. Several labs tried to replicate the experiment and failed, quickly papering the media with press releases dumping on P&F. A few labs confirmed the excess heat, but kept quiet about it, not wanting to upset government funding of their other research.

Now, nine years later, the foremost experimenter in the field, Dr. Jim Patterson, has a string of patents for systems which have been regularly producing enormous quantities of excess heat. Professor John Bockris of Texas A&M was one of the first to suggest that the excess heat might be coming from the transmutation of elements. His fellow professors immediately formed a lynch mob and tried to get him fired for making such a crazy suggestion.

Well, it turns out that Bockris was right. Elemental transmutation has been solidly confirmed. And this is providing, for the first time, a way to get rid of those thousands of tons of radioactive waste that have been building up. The cold fusion cells convert radioactive elements to non-radioactive elements. That's going to make the development of cold fusion power sources all the more difficult for the oil, coal, gas, and power companies to stop, even with all the money their lobbyists are lavishing on Congress.

Super Gardening

Another subject that has me all excited has to do with the different ways that have been discovered to speed plant growth. One of the books in my *Guide* (for which, apparently, no amount of pleading will get you to fork over a lousy five bucks) is a beaut by Chris Bird, *Secrets of the Soil.* Fabulous book.

One of the products described in the book was something called Sonic Bloom. At the time I read the book I sent a letter asking for more information. Nothing happened, so I almost forgot about it. But every now and then I'd hear Sonic Bloom mentioned, so I dug out my letter, looked up Dan Carlson on my phone ROM, and called him. Wow, was he interesting to talk with!

Dan sent me an information package and a video, which converted me from being interested to being really excited. This stuff is absolutely amazing!

What Dan discovered was that playing music to plants gets them to open up and draw in more nutrients, which helps them to grow faster and produce bigger, sweeter fruit and vegetables. He was getting three times the normal growth and huge fruit and vegetables—if you call 400-pound pumpkins huge.

His next step was to spray the plants with nutrients containing all the minerals long gone from our soil. The combination of the music and the spray is producing plants seven times as large as normal. He now has the world record for an indoor plant, a purple passion plant that's 1300 feet long! They normally grow to about 18 inches.

His video shows tomato plants with 500 tomatoes on a single vine, and interviews with a long string of exceedingly happy farmers who have been using Dan's system. It's producing bigger, sweeter fruit and faster growing plants, even under adverse growing conditions.

You can get a Sonic Bloom kit from Dan for $50, complete with audio tapes, and start growing your own giant vegetables or whomping up a bodacious science fair project: Scientific Enterprises, 708-119th Lane NE, Blaine MN 55434.

The Pyramid

At about the same time as I was being amazed by Sonic Bloom, I got a book from Acres USA called *The Pyramid* by Les Brown. It's a 20-year-old book, but it's a corker. Les built some small pyramids and found that they helped seeds and plants grow faster, make sweeter fruit, and the fruit stayed fresh much longer after being picked. He went on to build a 30-foot pyramid out of wood with three floors of garden in it.

This whole business about pyramid power is weird. I've read about it mummifying animals and sharpening razors. Then there is the mystery of the pyramids in Egypt, which we could not replicate today, even with all of our technology. The more I read about the pyramids, the more amazing they are.

Can the alleged power of pyramids be used to help our plants grow and produce better fruit and vegetables? Les Brown's book says yes, and he has the photographs to prove it. The 80-page book is $3 from Acres USA (#3045), (800) 355-5313.

If you're interested in the Great Pyramid, you'll enjoy a book packed with statistics about it. It's a scientific as well as a construction marvel. I found *The Great Pyramid Speaks* by Joseph Gill at Barnes & Noble for $7. Another great book is Peter Tompkins' *Secrets of the Great Pyramid.* This is a large (416-page), profusely illustrated book. Dowsers has it for $30, (800) 711-9497. Graham Hancock has also done a wonderful job in his *The Message of the Sphinx*, 350 pages, hardcover, $27.50 from Dowsers.

Radionics

While we're dealing with things unexplainable by science, but which anyone not too brainwashed to try can prove are real, we have what is called radionics. With this "power" it's possible to rid fields of pests and to improve plant growth. I've got a couple books on the subject, but I'll be getting more.

How is it possible to put a photograph of a field into a device and have it keep pests from bothering the crops in that field? Ridiculous, right? Well, so's dowsing, which has been working reliably for

thousands of years and still has no "scientific" explanation. Is it even remotely possible that there are still a few things we don't yet understand?

Look, we know that the accumulation of knowledge (and technology) has been speeding up. A hundred years ago scientists were just as certain as those today that they knew the fundamentals of everything. Ditto two hundred years ago.

If you know of any outstanding books on radionics, let me know.

Feeding Roots

Jim Patterson, the cold fusion pioneer, has a bunch of patents in many fields, but one of interest to farmers is his micro-piping system for delivering water (and nutrients) directly to the roots of plants. A bundle of tiny plastic tubes can be stuck into the ground next to a plant's roots and, by osmosis, will siphon water as needed to the root system from a jar or even a pipe system. This is particularly efficient for arid areas where it's important to keep water evaporation to a minimum. This could help open vast desert areas to cultivation in the Middle East.

Magnets

If you've read the Davis and Rawles book on magnetism, which I've recommended in my *Guide*, you know that plants growing over the south pole of magnets grow much faster than control plants. Those over north poles grow slower and tend to be deformed. The book is 132 pages and is $15 from Acres USA (#703).

I've been after Don Lorimer, who has been lecturing on the power of magnets to heal animals and people, to do a book on the subject. Once you get to know more about magnets you're going to be taking your freshly distilled water and putting it in the morning sunlight on top of the south pole of a strong magnet before you drink it—as I have been doing. Don has found that the south pole energy helps wounds heal incredibly fast, while north pole energy can slow down or stop cancer growth.

Prayer

In *The Secret Life of Plants*, also by Chris Bird, I learned that plants and humans can communicate. Anyone who wants to can prove this to themselves by planting a couple seeds in plastic cups. Select one seed to talk to. Tell it frequently what a fast growing, beautiful plant it is going to make. Think about it every now and then lovingly. Ignore the other seed. You can even plant a third seed and tell it every now and then how ugly and awful it is. Tell it how much you dislike it. The results will make you a believer.

On the same level, whatever that is, this same force also works on children and animals. I suppose that, no matter how much I've been after you to read *Kinship of All Life* by Boone, you haven't bothered. Spend the $11 and get it from Radio Bookstore (#5280), (800) 243-1438. The *Plants* book, same source, is $16 (#5300).

Gravel

John Hamaker and Don Weaver back up what Dr. Joel Wallach preaches in his *Dead Doctors Don't Lie* tape, plus in his books, *Let's Play Doctor* and *Rare Earths—Their Secrets to Health and Longevity*. The fact is that our bodies need a bunch of minerals that are no longer available to plants on our farms. Farmers have been substituting chemical fertilizer, which makes the plants grow, but doesn't provide us with the minerals our bodies have been designed to use over the millions of years they developed.

In the Hamaker-Weaver book, *The Survival of Society*, they call for the remineralization of our farms. Weaver documents the fact that remineralized earth grows healthier, bigger plants, with larger and sweeter produce. Cows fed hay from mineralized fields give more milk and have more meat on their bones in a shorter time. The book is $12 from Radio Bookstore (#6221).

Light, Too!

Another book reviewed in my *Guide* is *Health and Light* by Ott. Ott was a photographer who wanted to take pictures of plants and flowers. To keep them undisturbed for good photos he tried growing them in a box with a glass top. He got lousy plants. He found that the plants required ultraviolet rays from the sun in order to grow strong and healthy. His work was carried on by Jacob Lieberman in *Light, Medicine of the Future*, where he shows that people also need those UVs if they are going to be healthy. Yes, it's in my *Guide*, and you can get it from Radio Bookstore (#5430) for $17. You'll be out in the sun without your glasses for at least 20 minutes a day after reading this well documented book. Yes, I know that too much UV is harmful, but our bodies developed using UVs and we need 'em—particularly in our eyes.

Dirt

There are all kinds of soil, so it shouldn't be any real surprise that some sod is better than other for plants. So we want to learn how to provide an optimum soil for plant growth. There are a bunch of books on composting, which is a way to return your garbage to the soil. But mostly you want to read Bird's *Secrets of the Soil*, which Acres USA really should sell. Maybe it's out of print. Chris died a couple years ago, but I believe his wife is carrying on his work.

The bottom line, of course, is that the better the soil, the

Continued on page 38

Number 6 on your Feedback card

LETTERS

From the Ham Shack

Jim Stanley W6GH. You are correct in your position that we need to review and possibly modify amateur radio as it is today. Having been first licensed as an amateur more than 30 years ago, I am now observing a paradigm shift within the hobby, that previously I would not have expected. You are correct in your assumption that most young people are interested in computers and the Internet rather than radio. As my nine-year-old son stated, "Radio is boring ... there is no video." Or regarding packet operation, "Hey, this is really slow, can't we do this on the net?"

I personally did not own a VHF or UHF radio until a couple of years ago. Most of my hamming is confined to high power single point HF operation; lots of CW and usually never operating above 20 meters. I also spend much time on 160 meters operating my converted broadcast transmitter on AM. We even moved out of the city to get away from *any* restrictions on antennas so my patch of semi-rural real estate now looks like a antenna farm.

If we are to continue to enjoy this hobby and the associated spectrum made available to us, we must begin to develop technologies and modes that are applicable to current mediums such as the Internet and television. Both color video and high-speed data transmission are a must if we expect to interest young people. And let's face it, many of us were Novice amateurs when we were young. Amateur radio offered excitement and the potential for experimentation. For many individuals, such as myself, amateur radio provided the building blocks for a career in engineering and communications.

As an active VE with the ARRL VEC I am painfully aware of the low interest in upgrading to General, Advanced or Extra Class licenses. Most examinations we give today are for codeless Technician licenses.

One of the problems I observe today with regard to interest in HF operation is the cost of equipment. A decent transceiver from Japan costs about as much as a Pentium™ computer loaded with all the goodies. Which one do you think a youngster would rather have? Years ago most of us got our HF start with a one-tube transmitter, such as a 6L6 special, and perhaps a simple regenerative receiver. Nowadays, it's difficult for most youngsters to obtain the parts for a station such as this, let alone to find a kind, helpful, older ham to Elmer them. Then there is the problem of space for an HF dipole, if they live in an urban environment. The list of issues is extensive.

As someone who has devoted much effort to the CW mode even with spark transmitters, I must say it is a bitter pill to swallow, to think we must dumb down our hobby by reducing the proficiency requirements for CW in favor of more participants in the hobby. However, maybe we need to seriously consider reducing the proficiency for CW to five or seven wpm for the General Class license. Perhaps the Novice Class license could be issued for a term of two (2) years or four (4) years, with only a simple technical test consisting of FCC Rules and simple visual recognition of code characters; with no speed requirement for receiving. This would allow Novices to operate within confined band segments and learn Morse code on the air, like many of us did, in some cases without licenses.

Perhaps offering a license targeted at color ATV operation and high-speed data transmission for Internet connections would be attractive to many potential amateurs. Alas, if we older hams don't take action soon, there may be no amateur radio for our future generations to enjoy and learn from. I offer these ideas only as possible solutions to our dilemma and invite anyone to share their viewpoint on this subject.

Seems like a "Catch-22" situation. We need to keep upgrading our technology in order to attract youngsters, yet it is the youngsters who have always been the pioneers in the hobby, so without youngsters we aren't likely to have much progress. I don't agree that setting up even more license classes is going to solve anything. I also don't think that the cost of equipment is a serious problem. My first receiver (a seven-tuber, including the 80 rectifier) cost about $60. But that was in 1938 dollars, and that would come to around $1,200 in today's dollarettes. We're getting a lot of firepower for our bucks these days. Anyway, my proposal is to eliminate the stupid and divisive class system that the ARRL has promoted since antiquity and issue one *amateur radio license. Period. Then we need to get busy and add video to our contacts. We need faster packet. Much, much faster. We need repeater-Internet connections. We need duplex operation. We need to get out of the 1950s and into the 1990s with our technology ... Wayne.*

Steve Rudin W1WSN. There are no REAL surplus parts stores around; no cheap supply of crystals at a neighborhood store; no diagrams and descriptions in an easy-to-read *Radio Amateur's Handbook* for kids to plow through and build a 6AG7 five-watter as I did, using Popsicle® sticks stuck in drilled wood as a coil form; no ready source of old receivers or military equipment for "peanuts." And the thing that frightens me the most is that as we old-timers move on, the younger crop of amateurs will have increasingly fewer resources with which to build, play and learn.

This is my 45th year in amateur radio, without a break. I have been on CW, AM, SSB, RTTY, facsimile (beer-can drum home-brew units), packet, satellite, FM, etc. I've chased DX, rag-chewed, and contested. There was lots of motivation then ... old-timers who took you under their wing, surplus counters galore, even at Radio Shack™ (where I worked), ways to work the world on CW using a $5 transmitter and a power supply from an old TV—and yes, things have really changed.

I often wax nostalgic, and thus have taken to restoring old ham gear of years gone by. I hope that we will have a forthcoming generation of similar hams, who can delve into microprocessor-controlled imported computerized communications gear as well.

I still home-brew a lot of gear, but it just doesn't feel the same! And shopping for parts is a lot harder! I guess I still love the good old days!

Rev. Harry Arsenault K1PLR. Your comments on smoking hit home. My parents smoked and they're both dead. Secondly, on bad doctors, I concur. I have a Pharm.D., and being trained as a pharmacist, I see my profession as that which covers their (doctors') buns. I mean, "Do you *really* want to prescribe this?" As I was pursuing my graduate degree and working in a retail store, I was fascinated by the stupidity that could have caused drug interactions.

John Phillips K2QAI. You mentioned your mother calling you from a long distance when you were experiencing a profound crisis that she could have known nothing about, just to check on your welfare. Well, I have an interesting story to share with you. My 16-year-old son and the daughter of my friend

Continued on page 79

Number 8 on your Feedback card

QRX . . .

A QSL for Chuck

Chuck:

Hi! How you doing? Hey! Thanks for the contact on the *Mir* repeater last Thursday! I have a great story to go with it.

I saw a short story on the Colorado AMSAT Net Web page. It said that Chuck KIØAG had worked *Mir* on a rubber duck! That gave me all kinds of hope to work the *Mir* repeater on my HT with my home-brew yagi.

When I returned home after reading the Colorado AMSAT Web page at the Salt Lake City Library, I started to program my FT-530 for the *Mir* space station repeater frequency. I went into VFO (A) and programmed the uplink frequency with the 141.3 PL tone. Then I went to VFO (B) and I programmed the downlink frequency. My plan was to toggle back and forth as I worked the Doppler shift with the arrow keys. Not a bad plan for a first attempt. This could work, if I didn't lose my place making the up- and downlink Doppler shifts.

I checked the latest Sat-Track prediction for the *Mir* space station. I found that the best pass for my location in Salt Lake City, Utah, was at 1241–1252 UTC, local time 5:41 a.m. through 5:52 a.m. at a maximum elevation of 45.4 degrees. This would be the best pass of the day. "I wake up at 5:30 a.m. every day anyway," I thought. "No problem for me to work this pass. I'll still have time for a donut!" Yeah, right.

Well, at 5:00 a.m. I woke up and was still very tired. Knowing that my alarm was still set for 5:30 I went back to bed. At about 5:37 the alarm clock finally woke me up. I got up and let the dogs out. It was now about 5:40 a.m. I was still not dressed when I let the dogs back in. That's when I saw the clock in my ham shack. It was 5:43 a.m. *Mir* was up—and I was not!

I grabbed my FT-530 and quickly put on a fresh battery. I slipped on my shoes without tying them. I headed out the front door of my house, then ran back into the house to get my truck keys. My five-element yagi was on the front seat of my pickup truck and if I were going to make this pass work, I needed it. I opened the door of the pickup. I quickly connected the coax cable to the HT and turned it on. That's when I heard, "KIØAG."

"It's Chuck!" I said to myself. My antenna was still flat on the seat of my truck! I quickly pointed the antenna straight up into the dark sky. I toggled to VFO (A) and I called, "KIØAG, KC7QFS, Hi Chuck from Paul." I toggled back to VFO (B) but I didn't hear anything. I waited for what seemed like one or two minutes (but it was really about 10 seconds), then I remembered to make a Doppler shift on the downlink. I quickly made a Doppler shift, toggled back to VFO (A) and made another Doppler shift. Then I called Chuck one more time and toggled back to VFO (B). That's when I heard Chuck say "KC7QFS, KIØAG." It was about 5:48 a.m.

I walked out of the driveway into the street to get a better line of sight with the *Mir.* I looked up into the clear November sky. I could see the space station *Mir* moving across the blackness. Pushing the VFO and making other Doppler shifts was failing as *Mir* moved behind the mountains.

But I did it! I worked the *Mir* repeater with my friend Chuck at his home in Colorado! Plus, I did it with an HT on only two watts!

I was doing an end-zone dance in the street. It was then I realized I was still in my pajamas with a radio in one hand and a five-element yagi in the other—and a single thought in my head: Did I lock myself out of the house?

Yes, I once worked the *Mir* in my pajamas! How it got in my pajamas, I'll never know ... *with apologies to Groucho Marx.*—de Paul Michelsen KC7QFS.

Ham RF Exposure Guidelines (Effective January 1, 1998)

The FCC has published OET Bulletin 65, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," Edition 97-01, August 1997. Supplement B, "Additional Information for Amateur Radio Stations," was available in November.

For the latest news and linkage to related Web sites, visit the ARRL RF-Safety Web page at [http:www.arrl.org/news/rfsafety]. To obtain the FCC documents refer to the FCC site at [http://www.fcc.gov/oet/dockets/et93-62/] and go from there.

As part of the implementation of these new guidelines, there is a new Form 610 series, dated Sept. 1997. There are three new forms in this series: Form 610 is for basic transactions, Form 610-A is for operating privileges for foreign nationals, and Form 610-B is for club stations. These new forms must now be used for all licensing transactions (as of January 1, 1998). The new forms all contain a statement to the effect that the applicant understands and complies with the new RF Safety Regulations. The new Form 610 series can be obtained on the FCC WWW site at [http://www.fcc.gov]; the ARRL Web page at [http://www.arrl.org]; by contacting the FCC Central Phone Service at 1 (888) CALLFCC (225-7245); by writing the FCC at 1270 Fairfield Road, Gettysburg PA 17325-7245; or by contacting the ARRL.

There are several key dates to remember.

1. New licensees after January 1, 1998, must be in compliance with the new regulations at the time of first licensing. That is, the applicant will certify compliance by the act of signing off on the new 610.

2. All those licensed prior to January 1, 1998, will have to be in compliance with the new RF exposure regulations whenever a new Form 610 is filed for license renewal, upgrade, or other modifications.

3. All stations, new or old, must be in compliance with the new regulations no later than September 1, 2000. This date must be met whether a Form 610 has been filed previously or not.

From an article in December 1997's *MarcKey*, newsletter of Manteca (California) ARC.

Lack of Interest?

While conducting a study of sexual behavior, a researcher interviews an amateur radio operator.

"Can you tell me when you last made love?" she asks.

"Nineteen fifty-nine," he answers.

Having heard something of the lack of interest in sex prevalent among amateur radio enthusiasts, the researcher is sympathetic. "That's an awfully long time!" she says.

"I suppose," says the ham, glancing at his watch, "but it's only twenty-one fifteen now."

From ARNS Bulletin, *January 1998.*

The Doctor is Destinated: More Questions & Answers for the New Ham

Q. An antenna expert told me that the best antenna for my ham is a thing called a die pole. He explained how to make it even better by adding extra elements, but I can't figure out how to connect them.

A. *Actually, if it has more than two elements it is no longer a dipoie. Much less a die pole. The easiest thing to do would be to get your wife to hold a third element in close proximity to the center of the antenna formerly known as a dipole. She will most certainly resonate when you transmit, which is why this type of antenna is known as a naggi.*

Q. In building a kit, how do you know which component is which and where it goes on the printed circuit card?

A. *It's a lot easier than it looks. Just put components anyplace where they will fit. When you're finished you will have to send it back to*

the manufacturer to get it fixed anyhow, so why waste a lot of time?

Q. I've just bought a new whip for my mobile ham. A friend told me it probably needs to be swarred in. How do I do that?

A. *I bet your friend has a CB, right? We frown on CB talk here in the ham community. The correct terminology is VSWR, pronounced "V-S-W-R" for "vertical standing wave ratio," or "S-W-R" for short. This is the ratio of the standing waves (on the transmission line) to unity, or the input power. To measure them, try operating while you are standing vertically. If you hit the repeater better than when you are sitting, then you need to adjust your height. If you are hitting it about the same, then your VSWR is OK and your antenna is VIZ-WARRED in.*

Each month the Doctor will answer the most interesting questions from readers. Questions may be edited for length and clarity, which is why many of them disappear altogether. Address your questions to the Doctor in care of this publication.

Author anonymous, TNX *Low Down*, official journal of the Colorado QRP Club [cqc@aol.com].

Top 10 Reasons to Operate QRP

10. The power output will match your 10-foot whip.
9. You can't afford a big amplifier.
8. Your hearing aid battery will run your rig.
7. You joined Big Guns Anonymous.
6. Your whole rig will fit inside your microphone.
5. RF burns will heal quicker.
4. "That's not a lapel pin—that's my rig!"
3. You can still have fun during an emergency.
2. People can get "up close and personal" with their speakers.
1. You can operate from all 10 "most wanted" DX countries!

TNX Dennis W. Murphy KB6LZW.

So You Think KDKA Was First?

Most people believe that the first commercial AM station was KDKA in Pittsburgh—when Frank Conrad 8XK started playing records on the air for his friends and neighbors back around 1920. KDKA may have been the first station to receive a commercial broadcast license, but there was a thriving commercial station in existence 10 or more years before the government began regulating radio.

This station was in San Jose, California. It began broadcasting in 1909, using a crude spark transmitter. When it received its formal call letters it became 6XE, later KQW. Today it is KCBS, San Francisco.

Dr. Charles Herrold ran a radiotelegraph school in San Jose. In 1909 he began a regular schedule of voice and phonograph music to call attention to his school. His broadcasts, in those pre-vacuum tube days, were received by the same crystal sets used to receive spark gap Morse code.

By 1911, Dr. Herrold had developed a quenched spark generator consisting of a copper tube surrounding a precision-machined carbon rod. He immersed this spark gap in alcohol and he water-cooled the entire device. He applied modulation with a multiple-element, water-cooled carbon microphone in series with the high voltage supply.

Because of the alcohol bath and precision tolerances the arc carrier wave produced by this transmitter was considered to be exceptionally pure. One person described the signal as being inaudible unless modulation was applied.

Voltage for the transmitter was—at first—stolen, via a hooked stick, from a 600 VDC trolley line running outside a second floor window. Later, the trolley company installed permanent service to the station along with an electric meter. At one point, Herrold said, his transmitter consumed 9 kW from the electric supply.

Dr. Herrold kept up a regular schedule of music and news for over a decade. Besides broadcasting to the ham radio operators, he established a public listening hall several miles away in downtown San Jose. Since the loudspeaker had not yet been invented, people listened to his broadcasts on telephone handsets located throughout the hall.

Dr. Herrold's operation had all the trappings that distinguish a commercial broadcasting station. A local phonograph store supplied popular records for him to play on the air in return for mentioning the source of the records. Local musicians sang and played songs over the air. Dr. Herrold read news from the local paper. He sold cash advertising to department stores and food markets. He documented the size and location of his audience by inviting listeners to write in for a gift certificate that could be redeemed at a merchant near the listener. Over 4000 of these certificates were distributed. One of his sponsors, a candy company, promoted a specific type of candy on his programs. They claimed the sale of this item increased not only in San Jose, but in communities all up and down the Pacific coast.

These broadcasts developed enough of a reputation that when Dr. Lee deForest was unable to get his vacuum tube transmitter operating in time for the 1915 San Francisco Pan-Pacific Exposition, he used Dr. Herrold's transmissions—almost 50 miles distant—to demonstrate his new vacuum tube receiving apparatus. Throughout the run of the fair, Dr. Herrold's station was on the air at least eight hours a day.

Unfortunately, Dr. Herrold's apparatus would not function at wavelengths below 600 meters, so when the FRC established the present AM broadcast band in the 1920s, Dr. Herrold gave the KQW license to others who had sufficient capital to purchase new Western Electric™ equipment. At first it was used by the First Baptist Church of San Jose to broadcast its Sunday services. Later, the station added farm and agricultural news to the schedule. In the 1940s, KQW was sold to the CBS radio network and in 1951 it became KCBS.

Author's Note: This information comes from a collection of Dr. Herrold's papers that I found at work, compiled and published by a journalism professor in San Jose. The reference is *KCBS—Broadcasting's First Station, Records and Documents Supporting the Claim by Charles D. Herrold that He Established the World's First Radio Station in San Jose, California, in 1909, which is now KCBS.*

This article, by Lou Schneider N6YMQ, appeared in the September 1995 *GEARS Newsletter,* and was reprinted in the *ARNS Bulletin,* April 1997.

Spark Gap Cure Outlawed

Treating pain with a spark gap transmitter is illegal. So said federal officials who have halted sales of a device called The Stimulator.

The Stimulator was advertised on television as a pain reliever. The US Attorney's office contended that the apparatus is essentially a camp stove igniter that emits nothing more than an electrical spark.

But a spokesman for a firm that distributed The Stimulator claimed that it emits a charge to provide electromagnetic stimulation and that testimonials from customers say it does alleviate pain. The government did not buy the explanation or the testimonials. It declared that a spark gap will not cure any ills and ordered sales of the item halted immediately.

Via FCC Press Release; *Harmonics,* June 1997.

Truckez-Vous Mon Boat?

Ham friends to the rescue for Voyageur.

Sam Ulbing N4UAU
5200 NW 43rd St.
Suite 102-177
Gainesville FL 32606
[n4uau@afn.org]

These days, I can't believe I ever went sailing without a ham radio on my boat—like I did for a few years when I was not a ham. Fortunately, in 1997, when I started a planned 2000-mile cruise down the St. Lawrence River via Halifax, Nova Scotia, to the Chesapeake Bay, I did have a ham rig. My trip turned out to be a disaster, but the support of my many ham friends kept it from being worse.

The trip started on June 9, 1997, but the background for it had developed even before I was a ham. My wife Lee KD4DZX and I had retired on our Cape Dory 40 in 1986 and headed south. The first couple of years, we sailed and made many friends, but we were always sad when we parted since we knew we would probably never see them again. In 1987, we tried to sail from the Bahamas to Bermuda, a five-day ocean passage, where we were to meet a friend who was flying in. The weather turned bad, though, and we had to change our landfall to the USA. All the time, we were fruitlessly trying to use VHF to get a message to the friend that we weren't going to arrive in Bermuda. Obviously, no one heard us 300 miles out to sea!

Then, in the winter of 1987-88 in the Bahamas, I met Bob KA3OCS, sailing the *Malulani*, who dramatically changed my boating life. Bob showed me how he was able to keep daily contact with friends back home on his ham radio. More important, he showed me that I could get vital information from a place called the Waterway Net—weather reports which were not available on VHF in the Bahamas, due to the remoteness of most of the islands, and the latest information on customs procedures.

[The Waterway Radio and Cruising Club meets at 0745 Eastern time on 7268. For more information, contact Club Secretary Peter Nevins N3BBB at 1693 Anne Court, Annapolis MD 21401-6512 (SASE is nice) or E-mail petenevins@aol.com. The CW net meets on 7128 at 0700 and is less formal.]

Twice I heard a ham relaying life-saving information to a Coast Guard helicopter. In one case, a person had been severely injured by an outboard motor—but with the help of hams he was quickly evacuated by helicopter. The other case was a ruptured appendix. Far from the nearest town, the person might have died if the Waterway Net had not been there to organize help. I was convinced.

Although I had wanted to be a ham since the 8th grade, I had never got around to doing it. I realized it was time to get in gear. That summer I worked on my code. It was not easy, but I persevered and in July 1988 passed my Novice (KC4GJZ)—only to learn that if I wanted a reciprocal license to operate in the Bahamas, I had to have a General ticket. *Help!*

I knew the theory would not be a problem, but could I make 13 wpm by November, when we were due to leave? Out with the tapes, boring; better was W1AW—at least it had stories that were interesting. Memorizing has never been my strong point. I knew I had to do more. So I made the ultimate sacrifice: I got the key out and got on the air! I recall that first QSO—Lee says she thought I was going to die of a heart attack I was sweating so much and breathing so hard. I had written down what I had planned to say:

"GM, my name is Sam. My QTH is Naples FL. Your RST is nnn" ... a chance to ad-lib!

It worked great, except my first contact was with KA3OUL, from Mars,

Pennsylvania, and naturally that entailed a joke about being in Pennsylvania and not on the planet. Whoa, there: No one said Novices had to copy jokes. Did he say the planet Mars? Thank goodness for QRN; I did a hasty "Sri no CPI, QRN, 73" and went for an Extra-Strength Tylenol™! But I hung in, finally passed the General test and began to enjoy the benefits of ham radio. Little did I realize the dividends that would accrue for my trip in 1997.

From the log of Voyageur:

June 9, 1997, 0855: "Cleared Sodus Bay harbor, set sails, doing 5 knots."

I planned to spend several days sailing from Sodus Bay NY to Kingston, Ontario, where I would pick up George W2TOH and Mimi N2RNC, and then head down the river. This would give me a few days to finish the jobs I had postponed when I suddenly had to fix a sick starter two days earlier. The boat was bristling with ham gear: two two-meter rigs, my HF rig, and two QRP rigs which I hoped to use when I got to the islands of the Gulf of St. Lawrence.

The sail across Lake Ontario was pleasant, a nice light breeze and clear skies. It was a good start because Lake Ontario can be very rough—more than one boat has sunk there. In June fog is common but that day it was not very thick, so it was easy to spot the freighters crossing my path.

Photo A. *W2TOH loading assorted antenna parts.*

George, at his cottage in the Thousand Islands, and I maintained a regular sked on the Watertown (New York) repeater. I have found that on Lake Ontario, two meters is much more useful than marine VHF for a number of reasons. In general the average ham is a better, more polite operator, and the frequencies are often less crowded. On eastern Lake Ontario the most important reason is the existence of the Watertown repeater. While this repeater is located several miles inland, its antenna is 2000 feet high. This meant that with my 55-foot-high masthead antenna I was able to reach it wherever I sailed on the east end of the lake. [My two-meter (and marine VHF) antenna is a home-brew ground plane vertical copied from the ARRL *Handbook*. I have used it for five years now, and find it works as well as the expensive commercial ones.]

Marine VHF communications with land stations, on the other hand, was limited. Only the Coast Guard has antennas high enough to pick up my signal in the middle of the lake, but of course they don't handle "idle chitchat"—just life and death emergencies. Also, I could not file a float plan with them, but was encouraged to call them if my boat started to sink!

I wanted a better way to stay in touch with the world while I was out of sight of land, so I filed my float plan with George and checked in with him every two hours. I knew if I had a problem I could call on 147.255+ and even if George was not by the rig, there were lots of other hams listening who would relay a "MAYDAY" if it came to that.

The two-meter rig is a reassuring piece of gear on a boat. I found I was also using mine for planning purposes. My starter problem two days earlier looked like it might delay the schedule for picking up George and Mimi. Although I was not near a phone, I apprised George of this during our regular morning sked. He knew everything that was going on almost as soon as it happened.

Part of my routine on longer cruises is to give a position report at least weekly to the Waterway Net on 40 meters. This net was started to serve boaters in the southeastern USA and Bahamas. Now, more and more of its thousand-plus members are going elsewhere but still want to keep in touch. One day, after I had checked in to let the net know I was about to start my trip to Nova Scotia, I got a call from Randy NØILI, on *Oui Si*. I hadn't seen Randy since the Bahamas in 1993. He said he was sailing along the East Coast and expected to be in Nova Scotia around mid-August. Would I be there then? How nice! Here I was going single-handed to a distant place, and already a rendezvous was set up with an old friend!

Ham radio was also the reason George and Mimi would be going along. George had been a work acquaintance in 1979, but had retired and I had not seen him for years. One day in the Bahamas, we met a boat and got to chatting with its non-ham owners. When they learned we were originally from Rochester NY, the inevitable question was asked: "Do you know ... ?" This time we did! I told them I had known George since before I was a ham, and would they please let him know my call? A week later, George called me on the net and we reestablished our friendship. When I moved the boat to Lake Ontario, we talked daily on two meters and became good friends.

The St. Lawrence River is about 600 miles long and drains the Great Lakes into the North Atlantic via the Gulf of St. Lawrence. Halifax, Nova Scotia, where I planned to meet Lee for vacation, is 400 miles farther. The river starts out only a few miles wide, but with a strong current and much commercial traffic.

Any ship wishing to go to a port on the Great Lakes must use this river. By the time it enters the Gulf, it's 60 miles wide. In the first 180 miles downriver to Montreal, there are seven locks designed for oceangoing ships. Small boats are allowed to use the locks, but few concessions are made to these littler vessels.

It is advisable to have three people on board: two to handle the lines and one to run the boat. George and Mimi

were to go as far as Quebec City, 150 miles downstream from Montreal where the river starts to widen. They would be line handlers, and George had the additional title of radio officer.

While my two-meter antenna worked well, my HF antenna left something to be desired. I had never chosen to cut my backstay to make it an antenna, because I felt it was not wise to tamper with a major piece of structural gear (although many do with no problem). But I knew many boats with vertical backstay antennas and weak signals, so I had settled on a coax-fed inverted vee hoisted partway up the mast. It was neat and worked well on 40 meters, but was useful only at anchor. Further, it was very weak on 80 meters even though it tuned up. Several of my friends wanted to follow me on this trip. I needed a better "underway" antenna that would work on several bands.

At George's suggestion, I tried a ladderline-fed dipole cut at about 40 feet. Why 40? Why not? It was a nice length. I have a tuner on board so I could match the antenna, and I had found calculations of antenna length did not mean much on the boat. The metal rigging changes everything. My old inverted vee had the lowest SWR when it was about 26—not 33—feet long. Using a ladderline feed greatly improved the 80-meter signal. The fact that the ladderline runs inside along the boat's hull to the stern did not appear to hurt the signal. I hoisted one leg of the dipole with a lead from the top of the mast and ran the other along the deck. This "lazy inverted vee" worked and became my ship's antenna.

George also worried about my ability to communicate if I lost my mast or if the antenna wire broke and, since I planned to do most of this trip alone, he wanted an antenna that was simple to put up. He loaded a flock of Hustlers and other parts aboard the boat (**Photo A**) and said he would concoct the "Foxhole Antenna" during the trip.

My planned trip required many charts. I owned 150 but needed four more. One reason for going to Kingston was to meet up with John VE3LGS, on *Tumblehome*, whom I had met via the Waterway Net a couple of years earlier. John had a friend who had the charts I needed and would let me borrow them. Charts are a major investment for sailors, at $15 each, and I was glad not to have to buy them, since I would pass through the area they covered in less than a day.

June 13, 1500: "Anchored in Kingston harbor. Will clean boat, cash travelers' checks, review plans with Mike."

Kingston is a lovely tourist town with lots of sights, restaurants, and entertainment. It is also home for Mike VE3MBV, on *Ben-Varrey*. I had first met him and his XYL, Ursula, in Marsh Harbour, Bahamas, when I needed to fix a rip in a sail. Ursula had a sail sewing machine on board and offered to do it. Now Mike was taking me to the store for groceries. Perhaps he had an ulterior motive, as he was scheduled to be my crew from Halifax to Maine later in the trip.

While waiting in Kingston, I noticed a boat with an unusual antenna system on the stern (**Photo B**) so I dinghied over and met Fern VE2FSP, on *Robin Hood* out of Montreal. He showed me his home-brew 20-, 15-, and 10-meter dipole, which he could fold up out of the way, or let the arms down to use. As soon as Fern learned I was going downriver, he brought me aboard so he could point out some good places to know about on the trip.

***Photo B.** VE2FSP with* Robin Hood *and its folding dipole antenna.*

June 15, 1000: "All provisioned, charts on board, fueled up. George and Mimi due to board at noon and we will head downriver."

Sailing through the Thousand Islands is one of the wonders of the world. If you haven't done it I recommend it (there are many tour boats and places to rent boats). Operating /MM is fun and for US citizens a reciprocal is not needed—just be sure to add /VE3 to your call. It took full attention

***Photo C.** Bluenose II—or floating antenna towers?*

to control the boat through some of the narrow spots with swirling currents and it made me wonder how the early explorers ever got up the river without motors. That night we "dropped the hook" in a quiet cove and used the Watertown repeater to let VE3LGS know our QTH and that all was okay. The next day we'd be out of range of it and depend on HF.

The next few days we motored or sailed down the river, past towns, some big and busy, but most small and sleepy. Always lots of current. My boat only does about six knots, but we found that a two-knot current helped us to make many miles each day. Along the way we passed the *Bluenose II,* a replica schooner from Lunenberg, Nova Scotia, that was on a special tour of Canada. I looked at its two 90-foot-high masts and couldn't help wondering how an antenna would work up there (**Photo C**).

We settled into a daily routine. In the morning I'd pass our position and status usually to the Waterway CW net and in better conditions also to the SSB net. I generally preferred CW because it is more fun and in last summer's conditions was more reliable. Ed AD4FJ, whom I've known for several years and have yet to meet, would E-mail my status to Lee. (Will she ever learn CW and upgrade her Codeless Tech, so we can talk directly? Not to put the pressure on or anything ...)

Much of the time, George was busy working on his "Foxhole Antenna." If I understood all his technical jargon, it was a like a dipole but made with two Hustlers. "After all, a Hustler is a resonant device like a wire but a lot shorter." The idea was to use one Hustler as a vertical antenna and the other as a horizontal counterpoise mounted with a bracket on the stern rail.

He would have preferred to mount both horizontally at the top of my mast, but the tradeoff of using the mast for sailing purposes instead of an antenna tower won out! George spent a lot of time tuning for the frequencies I needed, and he used my new "Voltage Booster" (as described in my July 1997 *QST* article) to power his test gear so that he didn't have to run a 12-volt extension cord. George tried to make the antenna "idiotproof" by marking the exact lengths of the whips. He told me this was so that in an emergency I would not have to think, but I wondered if there was another message there about my antenna skills!

June 18, 0630: "Near Trois-Rivières—Forward water tank empty but we will be in Quebec City tonight."

We knew we were in Quebec province now because almost all the VHF traffic was in French. The current and wind were strong, causing big waves, and we were motoring into the wind. One of the classic places to "use caution and go through only in good weather" is the Rapids Richelieu. Here a rock bar lies across the river. A channel has been dredged out of the rock and all the current funnels through it.

> ***"Perhaps the best solution was just to ship the boat to Chesapeake and have it fixed there."***

June 18, 1100: "Hard going in the waves. Good to have a faithful engine."

At 1300, disaster strikes! The transmission breaks. One minute the boat was moving and the next we were drifting toward the shallows. Quickly George took the wheel, while I went forward to get some sails up so we could at least maneuver to avoid the shallows. I called the Canadian Coast Guard on VHF (fortunately their operators are bilingual) and they arranged for a tow into Quebec City. Repairs took a week and cost a lot of money, so I was feeling pretty low. But George and Mimi were determined to keep my spirits up, and they took me on a tour of old Quebec. On Friday, they had to leave and I was on my own.

Peter, a local sailor I had met, took me to a bank so I could get some money for grocery shopping. They needed to see my driver's license, and that's when disaster struck again: I had lost it! I remembered that the last time I used it was at the bank in Kingston so I called VE3MBV and asked him to check. The next day on 7268, I learned "no license." Oh, boy, first the starter, then the transmission, now the driver's license. Surely this is the end of it. But ...

June 24, 0800: "Underway again. Peter sailing with me to Gros Caucona."

The weather was nice, but there was no wind so we motored all the way. It was midnight and pitch-black dark when we motored through the Traverse de Saint-Roch. It is in this very narrow part of the river that the current is its strongest, up to eight knots. That's faster than I can motor, so I was using my GPS and radar as well as eyeballs to make sure I did not stray out of the channel.

June 25, 0400: "Arrive at Gros Caucona. Temperature 49 degrees."

That afternoon as Peter climbed up to the dock to catch his ride home, he said, "Now that you're into the saltwater part of the river, you're going to find it is a lot colder and foggier." Oh, great!

June 26, 0800: "18th day of the trip and all alone. Sunny and warmer with wind forecast NW 10 to 20. Should be good sailing. Had good SSB with George on 7220 and Mike on 7055 (I am /VE2 so 7055 SSB is okay). Also a nice CW with Kitty KD3UL; she will E-mail Lee. Expect to leave at 9 a.m. with a fair tide."

For the next three weeks I would be sailing alone, in open waters with harbors far apart, on a part of the river that was cold and foggy. Ham radio would be my main method of contact with the outside world. I was nervous but excited as I motored out of the harbor and slowed the motor to 1200 rpm so I could hoist the sails.

Disaster strikes again! The motor takes off all on its own and revs up to 3000 rpm or more. I try to stop it (on a diesel you pull a lever to cut off the fuel). Nothing. White smoke is pouring out the exhaust as the engine happily revs up. Will it finally just explode? How do I stop it? After 10 years (maybe it was 10 seconds—I'm not sure), the engine finally slows down and I can stop it.

OK, don't panic now ...

The engine has stopped, so it won't explode, but I don't dare start it again. Fortunately, the breeze is from the

right direction and the current is with me. It's 50 miles to the next harbor, so at five knots plus two for the current I should get there in seven hours—if the wind holds. Except that the current will change in about seven hours. In any case, I will need to get a tow and I'd better start letting people know so they can change their plans.

This seems like a major problem; perhaps I'll need a new engine. I call the Coast Guard. It's the same voice I heard on my call the week before. I explain today's problem and say I am going to sail to Rimouski but will need a tow in and is there a mechanic there?

In the process of explaining, I mention that I will use my ham radio to pass other messages. The voice says, "What's your call?" Turns out he is Andre VE2ABK, and he will try to help. Half an hour later, Andre calls to say he has called the marina at Rimouski and has arranged everything. My next call was on the Waterway Net frequency. I knew the net was over, but there is usually someone listening. Sure enough, I got Claire KC4LBZ. She would call Lee to tell her the bad news.

Nothing to do now but sail and think: How lucky I was that both problems had occurred just *after* I had passed through dangerous waters. How scary it is to have a runaway engine and not be able to stop it. I began to realize how much support I was getting from my ham friends on this trip and how nice it was to be able to pick up the mike (or key) and talk to a friend when I was in need. It was dark by the time the towboat got me into Rimouski.

Being broken down in a remote town in Quebec is less than ideal if you do not speak French. I had to ask the marina to call a mechanic. One said he would be there by noon, but he never did show up. I learned he was sometimes not very dependable. The second-best mechanic was out fishing for "several days." The third-string mechanic, a ship's mechanic from a freighter, said he would look at it as soon as he could, but was busy with two other boats and really did not know much about my kind of motor—it was too small.

Photo D. *Voyageur* *awaiting the truck. Just visible are the ladderline to dipole on deck and the "Foxhole Antenna" on stern rail.*

After a long-distance call to a mechanic in the States, I learned that my problem was probably a bad injector pump. Now the difficulty was defined—but how to fix it? More long-distance calls and I learned that if I could somehow get my boat towed 60 miles back upriver and get the mast taken down, there was a marina that would call a mechanic to come from Quebec City, 100 miles away, to fix it.

It was beginning to look like a very expensive and time-consuming repair job. And there was still the language problem. I was beginning to feel overwhelmed. Perhaps the best solution was to just ship the boat to the Chesapeake and get it fixed. That too would be expensive, but probably no more so than fixing it here—and if repairs took a month at Rimouski it would be too late to finish my trip anyway.

The following morning, I passed my plight to the CW net and also to VE3LGS, VE3MBV, and W2TOH on SSB. Suddenly things began to look up. VE3MBV suggested I truck the boat back to Kingston. It was cheaper, the mechanics speak English and, best of all, Mike had done a similar repair job on his boat and offered to help me. I thought if I did that, I might be able

Photo E. *VE2ABK with his daughter.*

to salvage some of the summer sailing and of course I would learn a lot from working with Mike.

The next day Mike told me he had talked to a marina: There was a slip for me, we could do the engine work, and there was a mechanic who would counsel us. He had also called the diesel dealer to check parts availability. But how to find a trucker? *"Truckez-vous mon boat?"* wouldn't cut it in Rimouski. VE3LGS said he knew a company that was nearby—as well as the owner. A few phone calls and it was arranged. All this time, AD4FJ was sending E-mails to Lee.

June 30, 1100: "Boat hauled out onto land and the mast taken down. Truck due July 3."

Now I had a chance to try the "Foxhole Antennas" (**Photo D**). They worked, but not as well as the "lazy inverted vee" hoisted on deck. I used a broom at the stern, a six-foot pole I found in the trash at the bow, and a boat hook which extended to eight feet in the center. The 40-foot legs hung over the ends of the boat. I realized that if the boat were floating instead of on land, the ends of the dipole would be dragging in the water and the antenna most likely would not have worked at all.

Working on the boat that afternoon, I heard "Hello, *Voyageur!*" and looked out to see a guy in a tee shirt (**Photo E**). "Hi, I'm Andre VE2ABK, the Coast Guard operator who handled your calls. I thought I'd drive down and see how you are making out and if I can help." We chatted, I showed him my "shack" and we swapped QSL cards. I know every time I look at his card, I will have a lot of memories.

July 4, 0930: "Boat and I arrive in Kingston. Mike and Ursula here to greet us."

Mike had arranged for the mechanic to come to the boat that afternoon. It was all downhill now. Mike and I spent two days removing the injector pump, with him doing most of the dirty work. A week to get it repaired gave me time to do other things, like re-rig the boat and make new vacation arrangements for Lee. All this time, as you can imagine, the boat was a mess. Cooking was out of the question, but Mike and Ursula came to the rescue again, by having me over for dinner most nights. Two more days of dirty work and an hour of the mechanic's time got the engine running like new with no damage done by the runaway.

Lee changed her vacation to come to Kingston and, to celebrate, George and Mimi drove over to Kingston to join Mike and Ursula and us for lunch. (John was away sailing.) Mike finally got to sail, but only back to Sodus Bay instead of to Maine. Maybe next year?

Well, that was my trip. A small sailing story but one that showed me the benefits of being a ham. I'll never go to sea again without a ham radio! 73

Wouldn't You Really Rather Drive a BUIC?

Part 2: software for your interface circuit.

L. VanProoyen K8KWD
8330 Myers Lake NE
Rockford MI 49341

While it is somewhat beyond the scope of this Basic Universal Interface Circuit article to cover the gambit of programming techniques required to produce a slick radio control program, I have included a few things that should be of help in understanding ICOM's CI-V and Kenwood control software requirements. And who knows? It may be just the incentive some of you need to continue experimenting and writing just such a program.

Part of my reason for "rolling my own" software is that inevitably I'll find I want to do something that a commercial package won't allow, and without source code ... well? Also, in keeping with my objectives in starting this project, I wanted to explore the control software requirements a bit to increase my understanding of how my radio(s) worked, and writing my own software is certainly the most cost-effective approach to that.

To do all this, the first step I needed to accomplish (after getting the interface working) was to acquire an ability to display data from the radio in some usable form. My ICOM manuals told me that the data was in hexadecimal format, as are commands, etc., so I used the Windows™ terminal program to save the data to a file which I later viewed under DEBUG (DEBUG displays file data in a hex format). I wanted to see if the data looked at all like the radio manual's description, and it did—sort of.

Eventually, the terminal program and DEBUG routine proved tedious, so I came up with the QBASIC routines for ICOM radios shown below:

Port initialization. Note: This usually has to be run once per session.

```
OPEN "COM1:1200,N,8,1,CD0,
CDS0,OP0,RS,TB1024,RB1024"
FOR RANDOM AS #1
```

Check for Receive buffer characters.

```
PRINT LOC(1), #1
```

Write Receive buffer to a string for display.

```
a$ = INPUT$(LOC(1)), #1
```

Display input string in hex format.

For i = 1 to len(a$):

```
PRINT  HEX$(ASC(MID$(a$,i,1)
));:
PRINT " ";:next i
```

Command string constants. Note: rad$ (radio ID) is radio specific. Hex 48 is for the IC-706.

```
hdr$=chr$(&hfe):rad$=chr$
(&h48):
cad$=chr$(&he0):=end$=
chr$(&hfd):
nul$=chr$(0):fqw$=chr$(5)
```

Write a frequency (146.520) to radio (see below for data format and protocol).

```
PRINT #1, hdr$;hrdr$;rad$;
cad$;fqw$;nul$;chr$(&h52);
chr$(&h46);chr$(&h01);end$;
```

Send commands to radio (see radio manual CI-V info for command codes; also below).

```
PRINT #1, hdr$;hdr$;rad$;
cad$;chr$(&h{command});chr$
(&h{secondary code if needed
});end$;
```

To make things easier, I chose QBASIC because it's bundled with

```
'Sample QBasic Frequency Write and Display Program
'for ICOM Radios with CI-V Remote Jacks .. K8KWD.
'This program was tested on the IC-706 and IC-756
'(with CI-V address changed to 48h, Auto Baud selected
'and Transcieve ON) using a
'Compaq Aero Notebook Computer 8-10-97.

OPEN "com1:9600,n,8,1,cd0,cs0,ds0,op0,rs,tb1024,rb1024" FOR RANDOM AS #1

hdr$ = CHR$(&HFE): rad$ = CHR$(&H48): cad$ = CHR$(&HE0): end$ = CHR$(&HFD)
nul$ = CHR$(0): fqw$ = CHR$(5): fqr$ = CHR$(3)
w = 0: in$ = "": B$ = ""

SCREEN 1 'set up the big screen

'FOR i = 1 TO 4096: NEXT i 'add delay if necessary
PRINT #1, hdr$; hdr$; rad$; cad$; fqr$; end$; 'get initial freq data
'FOR i = 1 TO 4096: NEXT i 'more delay here if required

WHILE w = 0    'start the main loop
  IF LOC(1) > 10 THEN
    CLS
    LINE (75, 70)-(250, 100), , B 'draw box around freq display area
    ip$ = INPUT$(LOC(1), #1)
  END IF

  IF LEN(ip$) > 10 THEN 'update frequency display
    freq$ = RIGHT$(ip$, 11) 'make sure enough data gets transfered
    LOCATE 12, 15
    PRINT HEX$(ASC(MID$(freq$, LEN(freq$) - 1, 1)));
    PRINT HEX$(ASC(MID$(freq$, LEN(freq$) - 2, 1))); ".";
    PRINT HEX$(ASC(MID$(freq$, LEN(freq$) - 3, 1)));
     m$ = HEX$(ASC(MID$(freq$, LEN(freq$) - 4, 1)))
    PRINT LEFT$(m$, 1); ","; RIGHT$(m$, 1); 'put a comma between khz & hz
    PRINT HEX$(ASC(MID$(freq$, LEN(freq$) - 5, 1)));
    PRINT " MHz";
    ip$ = ""
    LOCATE 2, 2: PRINT "ICOM Frequency Control Program - K8KWD"
    LOCATE 24, 1: PRINT " f-key to Enter Frequency ";
    LOCATE 25, 1: PRINT " Q-key to Exit ";
  END IF

  B$ = INKEY$ 'scan for keyboard inputs
  IF B$ = "f" THEN 'we want to do a frequency write
     LOCATE 5, 10
     FOR i = 1 TO 33: PRINT " "; : NEXT i 'clear screen area
     LOCATE 5, 10
     LINE INPUT "Enter Freq MHz.kHz "; c$
     i5 = 0 'this was a pesky little problem with my math
     d = INSTR(c$, ".") 'figure out where decimal point is
     IF d >= 1 THEN 'add a little trap for garbage keyboard entry
       m$ = LEFT$(c$, d - 1): k$ = MID$(c$, d + 1) 'split MHz & kHz
       ma = FIX(VAL(m$)): ka = FIX(VAL(k$)) 'make them into numbers
         IF LEN(k$) = 1 THEN ka = ka * 100
         IF LEN(k$) = 2 THEN ka = ka * 10
         IF LEN(k$) = 4 THEN
           i5 = ka MOD 10: ka = ka \ 10
          END IF
         IF LEN(k$) = 5 THEN
           ka = ka \ 10: i5 = ka MOD 10: ka = ka \ 10
          END IF
         IF LEN(k$) = 6 THEN ka = ka \ 1000
         IF LEN(k$) > 6 THEN ka = 0
       db5 = ma \ 100: i1 = ma MOD 100: i2 = (i1 \ 10) * 16: i3 = i1 MOD 10
       db4 = i2 + i3: i1 = (ka \ 100) * 16: i2 = ka MOD 100: i3 = i2 \ 10
```


Continued

```
      db3 = i1 + i3
      db2 = ((i2 MOD 10) * i6) + i5
      LOCATE 6, 20
      FOR i = 1 TO 33: PRINT " "; : NEXT i 'clear screen
      LOCATE 6, 20
      PRINT #1, hdr$; hdr$; rad$; cad$; fqw$; nul$;
      PRINT #1, CHR$(db2); CHR$(db3); CHR$(db4); CHR$(db5); end$;
      FOR i = 1 TO 4096: NEXT i 'add a little recovery delay
    END IF
    PRINT #1, hdr$; hdr$; rad$; cad$; fqr$; end$; 'update freq display
  END IF 'end of if freq write

  IF B$ = "Q" THEN w = 1 'that is all folks
WEND
```

***Sidebar 1.** Sample ICOM CI-V control program listing, ICOMTST.BAS.*

most recent versions of DOS, and therefore on many computers. While it is not generally installed with Windows 95, if you snoop around the "CAB" files on 95's distribution disk, you should be able to find it included. QBASIC worked fine for my experimenting (and my initial control program), so long as I remembered to start it from (the DOS prompt under) Windows. For some reason, trying to access ports directly from DOS causes my computer to go to lunch—some missing driver, I suspect.

ICOM control software

I continued experimenting with the CI-V system by coding test lines as shown above and saving them to a file (so I could recall them later). By commenting out (') lines, editing others, skipping to QBASIC's "Immediate" screen to try other things, etc., I was able to find out a lot about the data formats, required protocols, etc.—things you need to know to write control software. Many of these types of details were not intuitively obvious to me from the information contained in my radio manuals.

Most of what I was able to figure out about the ICOM CI-V command structures and data formats is as follows:

General command format.
`hdr$ hdr$ rad$ cad$ cb$ sc$ {data} end$`

Where: hdr$ = FE (hex); cad$ = E0 (computer's address); rad$ = 48 (hex IC-706 address); cd$ = hex command byte; sc$ = hex secondary command; cnd$ = FD (hex terminator byte)

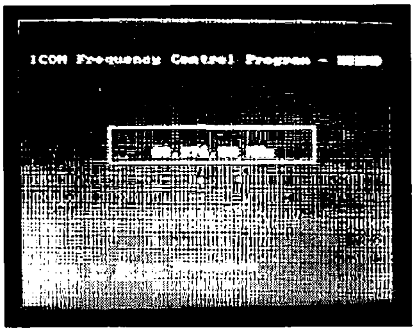


Photo F. *Computer display showing frequency control and display for an ICOM IC-756 using the basic universal interface with the sample program "ICOMTST.BAS" (see* ***Sidebar 1****).*

Note: See radio manual for specifics on command and secondary code values (cd$ and sc$) and your default radio address (rid$).

Frequency data format: five data bytes, ascending byte order, descending byte value order with 1/2-byte BCD digit coding.

`DB1 DB2 DB3 DB4 DB5`

Where: DB1 = 10 Hz & 1 Hz BCD digits; DB2 = 1 kHz & 100 Hz BCD digits: DB3 = 100 kHz & 10 kHz BCD digits; DB4 = 10 MHz & 1 MHz BCD digits; DB5 = 1000 MHz & 100 MHz BCD digits

Example: To write 147.525 MHz, the command string would be `FE FE 48 E0 05 00 50 52 47 01 FD`.

Example: To write 3.795123 MHz, the command string would be `FE FE 48 E0 05 23 51 79 03 00 FD`.

Note: Spaces are shown between the hex value bytes for clarity only. The frequency write sequence is 11 bytes total length. Also, note that for frequency writes, the secondary command field is used for data.

Radio output data format.

`hdr$ hdr$ cad$ rad$ nul$ {data} end$`

Where: Values and formats are similar to those in transmit.

Example: The radio outputs frequency data whenever the VFO knob is operated. For my IC-706, setting the VFO to 146.520 results in the radio generating a final data block that looks like this:

`FE FE 00 48 00 00 00 52 46 01 FD`

Note: This data looks a lot like the command string for frequency write, except that the radio inserts zeros in the cad$ and command fields to complete the eleven-byte data block.

Miscellaneous commands—Set Mode.

`hdr$ hdr$ rad$ cad$ chr$ (&h{mode cmd}) chr$(&h{sub cmd}) end$`

Where: {mode cmd} and {sub cmd} values are included in the radio's manual.

Example: To set CW mode, for example, the command block looks like:

`FE FE 48 E0 06 03 FD`

Note: The data stream received by the computer after sending this command looks something like this: `FE FE E0 48 FB FD`. The "FB" in the fifth byte position indicates the command was received OK. The radio returns "FA" in this location in case of error.

Miscellaneous commands–Get Frequency.

`hdr$ hdr$ rad$ cad$ chr$ (3) end$`

The radio replies with the following data:

`FE FE E0 48 03 00 00 52 46 01 FD`

when the current frequency happens to be 146.520 MHz.

Note: The "03" command is echoed back in the command byte field.

Miscellaneous commands—Get Mode.

`hdr$ hdr$ rad$ cad$ chr$ (4) end$`

The radio replies with the following data:

`FE FE E0 48 04 05 01 FD`

Note: Mode data is contained in the sixth byte field as "05" (which translates to FM mode). The mode codes follow those used to Set Mode, and are included in the radio manual. The fifth byte again echoes the Get Mode command. The seventh byte ("01") indicates normal filter selection. If a narrow filter were selected, this byte would be "02". Again, this information as well as more "Miscellaneous Commands" should be in the radio manual's "Remote Jack (CI-V) Information" section.

I understand there's a CI-V reference manual available through ICOM's parts department, and it might be a good investment for those contemplating development of a more comprehensive control program. As for me, I was able to meet my basic objective with a few additional formatting and decoding functions to deal with keyboard entry and screen display of frequency data.

Kenwood control software

Kenwood radios are perhaps easier to write control software for because command and data formats are in ASCII text format. This means you can use a standard terminal program such as that bundled with Windows to send commands and display data, although a custom program to enter and display data in a more "user friendly" format is much nicer to use.

Obtaining a manual for Kenwood's IC-232C might be a good investment for those whose primary interest is in Kenwood radio applications. This manual includes quite a bit of command reference which would be useful in developing Kenwood radio control software. The TS-50 uses a subset of commands that many Kenwood radios use, and I have included those of which I am aware below:

General command structure.

All commands must be in uppercase letters and are terminated with a semicolon (;). Many commands perform dual functions, e.g., they can be used to both read and write data.

ID:

Returns radio identification number:

`ID004;`

for the TS-440, for example.

`ID013;`

for the TS-50, for example.

IF:

Returns current status in a 35-character string such as:

`IF00018500000XXXXX-015000X0701000XXXX;`

Where: "X" inserted here for typesetting purposes means blank space, would normally appear as gap or unoccupied. The first eleven characters

```
'Sample QBasic Frequency Write and Display Program
'for the Kenwood radios .. K8KWD.
'This program was tested with the TS-50 using an
'IBM ThinkPad Notebook Computer 6-18-97.

OPEN "com1:4800,n,8,2,cd0,cs0,ds0,op0,rs,tb1024,rb1024" FOR RANDOM AS #1

SCREEN 1 'set up for big screen display
         'this seems to work for most displays .. CGA to VGA

PRINT #1, "FA;"; 'get VFO A's freq for initial display

WHILE w = 0    'this is the main program loop
  IF LOC(1) > 10 THEN
    'draw box around frequency display area
    CLS
    LINE (75, 70)-(250, 100), , B
    ip$ = INPUT$(LOC(1), #1) 'read input data
  END IF

  IF LEN(ip$) > 13 THEN 'update frequency display
    freq$ = ip$ 'make sure enough data gets transfered
    i = LEN(freq$)
    LOCATE 12, 15
    PRINT MID$(freq$, 6, 2);
    PRINT ".";
    PRINT MID$(freq$, 8, 3); ","; MID$(freq$, 11, 3);
    PRINT " MHz";
    ip$ = ""    'zero the input string after getting data
    LOCATE 2, 2: PRINT "Kenwood Frequency Control Program - K8KWD"
    LOCATE 24, 1: PRINT " f-key to Enter Frequency ";
    LOCATE 25, 1: PRINT " Q-key to Exit ";
  END IF

  b$ = INKEY$ 'scan for keyboard inputs
              'this routine looks only for f or Q
              'note lower & upper case distinction
  IF b$ = "f" THEN 'do a frequency write
                 'clear out the screen area for display
     LOCATE 5, 10: FOR i = 1 TO 33: PRINT " "; : NEXT i: LOCATE 5, 10
     LINE INPUT "Enter Freq MHz.kHz "; c$
     d = INSTR(c$, ".") 'figure out where decimal point is
     IF d >= 1 THEN 'add a  trap for bad keyboard entry
       m$ = LEFT$(c$, d - 1): k$ = MID$(c$, d + 1)
             'split data into MHz & kHz components
       IF LEN(m$) = 1 THEN hdr$ = "FA0000" ELSE hdr$ = "FA000"
       IF LEN(k$) = 0 THEN tl$ = "FA000000;"
       IF LEN(k$) = 1 THEN tl$ = "00000;"
       IF LEN(k$) = 2 THEN tl$ = "0000;"
       IF LEN(k$) = 3 THEN tl$ = "000;"
       IF LEN(k$) = 4 THEN tl$ = "00;"
       IF LEN(k$) = 5 THEN tl$ = "0;"
       IF LEN(k$) = 6 THEN tl$ = ";"

       LOCATE 6, 20: FOR i = 1 TO 33: PRINT " "; : NEXT i: LOCATE 6, 20
       PRINT #1, hdr$; m$; k$; tl$;
       hdr$ = "": m$ = "": k$ = "": tl$ = ""
       FOR i = 1 TO 4096: NEXT i 'add some recovery time delay
     END IF
     PRINT #1, "FA;"; 'request VFO A frequency update
  END IF 'end of if frequency write

  IF b$ = "Q" THEN w = 1 'end  the program
WEND
```

Sidebar 2. Direct frequency entry and display program for the TS-50, KNWDTST.BAS.

represent frequency in the same format as "FA" above. Characters 12 through 16 are not used. Characters 18 through 21 represent RIT frequency in Hz, with the 17th giving the direction as plus (+) or minus (-). Characters 22 and 23 indicate RIT/XIT status respectively; zero = off, one = on. Character 24 is not used. Characters 25 and 26 indicate memory channel number. Character 27 indicates whether the radio is in receive or transmit; zero = receive, one = transmit. Character 28 indicates current mode (see mode command above). Character 29 indicates function similar to function command described above. Character 30 indicates whether scan is on or off; zero = off, one = on. Character 31 indicates if split mode is on or off; zero = off, one = on. Characters 32 through 35 are not defined.

FA;

Returns current VFO A frequency as:

`FA00014317000;`

for 14.317000 MHz, for example. The frequency data is in an eleven-digit format with the leftmost digit representing the 10 GHz value, and the rightmost, the 1 Hz value.

FA[data];

Writes a frequency to VFO A. Note that there are 11 data digits that must be filled (using zeros as appropriate) for this command to work. It's possible with the TS-50 (and, I suspect, other Kenwoods) to write frequencies to the 1 Hz level.

FB; and FB[data];

Same as FA; and FA[data]; as described above, except that these commands read or write frequency data from/to VFO B.

FN[Cmd Code];

Function command, selects VFO A/B or Memory. FN0; = VFO A. FN1; = VFO B. FN2; = Memory mode.

MD[Cmd Code];

Mode command, sets Communications mode. MD1; = LSB. MD2; = USB. MD3; = CW. MD4; = FM. MD5; = AM. MD6; = FSK.

RX;

Commands rig to receive (see TX; command).

SP[Cmd Code];

Sets Split mode on or off. SP0; = off. SP1; = on.

TX;

Switches radio to transmit. Once sent, the radio remains in transmit until the RX; command is sent (or power off).

Program listings

Finally, I have included a listing of my QBASIC program, "ICOMTST.BAS", as **Sidebar 1.** It shows how I keyboard-enter and display frequency data for my ICOM radios. **Photo F** shows the computer display presented by this program. Similarly, I've included a listing of "KNWDTST.BAS" as **Sidebar 2.** This shows a similar implementation for the Kenwood radios.

I will be happy to provide ASCII copies of these listings on IBM diskette to those who send me a blank disk and self-addressed, stamped diskette mailer. Have fun!

Getting High the Ham Way

Adventures in ATV rocketry.

Andreas Forrer KB9MRB
3700 N. Lake Shore Dr., #304
Chicago IL 60613

Encouraged by "Rocket Video" in the July 1997 issue of *73 Amateur Radio Today,* we decided to present our experiences with rocket video to a wider audience. Transmitting live video from a rocket in flight, however, is about the only thing our project(s) has in common with the one described by author Jeff Johnson KC5AWJ. We are not trying to break the sound barrier; as a matter of fact we try to stay below it, although we can't help breaking it once in a while. Going beyond the speed of sound creates a multitude of aerodynamic and structural problems for the rocket, which increases the complexity of a project like this (hey, it's called "rocket science" for a reason!).

We use live video downlink normally for two reasons: first, as pure entertainment for the audience; and second, as a way to do aerial photography. Since we use the live video downlink only as a way to achieve a different goal and not as the object of the project itself, we decided to keep it as simple as possible. We achieved this by putting off-the-shelf components together: From PC-Electronics we bought the TXA5-RC ATV transmitter board, which is capable of 1.5 watts PEP, enough power to receive a picture from a rocket at altitudes beyond 50,000 feet AGL (another group of people actually flew a similar setup to even higher altitudes). Although this transmitter could be equipped with a sound board, we did not use that in our flights. Ground tests of that board were not satisfying. Instead we flew once the XTL3000 transmitter from Xandi Electronics with a microphone. Although the reception was clear, the sound itself was rather disappointing. Of course, it depends on where in the rocket you position your microphone, but all we got out of it were some typical wind and engine thrust sounds—nothing really spectacular, and it didn't seem worth the effort of adding all this equipment to the payload.

> **"Experience shows that, in rocketry, the best solutions are the simplest ones."**

The ATV transmitter was fed by eight 1.5 V AA batteries, which let it operate at its lower power limit. Since our flights did not go beyond 20,000 feet and the transmission time at around 10 minutes was rather short, we were able to get away with this simple approach. We experimented with even less battery power (9 V alkaline and a series of camera batteries), but it seems that eight 1.5 V AAs is about the lower limit of operating power for this transmitter.

Another point of discussion is the ideal camera setup. According to PC-Electronics' information sheet (it comes with the transmitter), the ideal antenna is a horizontal omni with two dipoles at 90° fed to the same coax leading to the transmitter. The dipoles are sticking out of the rocket body tube to either side. The reason for the dipole is that a rocket normally rotates around its longitudinal axis, due to imperfections in the construction. So we tested this configuration on several flights. Actually, on the first one, we embedded the two dipoles within canard fins mounted about halfway up the rocket body. Although that made them less of an aerodynamic drag problem, these canard fins typically created lift. Unfortunately, it was enough lift to steer our rocket off course. Combined with a

Photo A. The experimental rocket is being prepared for launch. The author inserts the pyrotechnic igniter into the composite motor while two friends check the ATV test transmission. The CCD camera looks through a window below the silver ring underneath the nose cone.

motor, which was close to being under-powered for the size and weight of the overall vehicle and somewhat oversized fins at the end of the rocket, this caused the rocket not only to weathercock, but actually to turn almost 90° and fly horizontally—similar to a cruise missile. From this experience we learned that it might have been a better idea to hide the dipoles within the regular fins at the end of the rocket, but that solution makes it difficult to mount the transmitter and camera, as the booster section normally has not enough space for these parts. Also, we did not want to make the antenna feedline any longer than absolutely necessary.

Photo B. The ATV elements removed from the payload section show, at the left, the power regulator and battery pack for the camera, and the camera itself. To the right are the battery pack for the transmitter (mounted lower within the rocket body) and the whip antenna. The transmitter is on the other side of the board and balances the weight, as the board is mounted vertically.

We decided to hide the dipoles in two Nylon™ tubes sticking out of the body frame. Although not ideal from an aerodynamic perspective, this would at least not cause any lift forces. Tested on several flights, this solution worked quite well, but we were still not perfectly happy because of the added drag. Also, we weren't sure how fast we could actually go with this configuration without breaking it in the airflow.

We decided to try a different approach and use a simple whip antenna, knowing that we might lose reception due to the rocket's rotation. We replaced the dipoles with a Diamond RH77CA whip, which we mounted vertically within the body tube. Obviously, this restricts the choices in the selection of the material for your body tube. Aluminum and carbon fiber would shield the antenna, so we decided to use phenolic tubing reinforced with several layers of Fiberglas™ (this also prevents the brittle phenolic tube from cracking). The flight results were very encouraging: almost no loss in picture quality. Although each rotation of the rocket can be detected by a brief buzz in the picture, we never really lost the signal. We might even go as far as to argue that this is an added benefit, since we were now able to determine the roll behavior of our vehicle. This was a welcome surprise, since even with the dipoles approach, we were still able to spot the occasional buzz in the picture, when the phases shifted. These results, however, were not completely unforeseen—as we learned from talking to another group of high power rocketry enthusiasts, who also use the Diamond antenna instead of dipoles.

Since the transmitter requires only a regular video signal as input, it's builder's choice regarding the camera. We flew a high resolution color camera with a built-in power regulator. This camera from SUN computers was designed for video-conferencing via the Internet and was very compact. Again, we had to find a reliable, but small enough, power source for it. Although the camera uses a similar input voltage as the transmitter, we followed PC-Electronics' advice concerning separate power sources for transmitter and camera. We experimented with various configurations and concluded that the eight AA 1.5 V batteries would do just fine. The camera would run out of battery power after roughly 30 minutes, while the transmitter could live on for at least another 15 minutes.

Photo C. The rocket's two-colored booster passes by the camera window within the payload section.

Photo D. This shot of Bong Recreational Area in Wisconsin was taken during descent. Clearly visible are the pathway leading through the park and the ramp towards the runway in the lower right-hand corner. The white "cloud" is a reflection of the sunlight in the window.

We used the color camera on a demonstration flight in Sheboygan (Wisconsin) at a "Rockets for Schools" event. The live feed was projected onto big screens, on which the audience was able to watch the events. Seeing the rocket blast off into a blue sky, then the booster separate and eventually the waters of Lake Michigan approach for the splashdown was quite a crowd pleaser (a friend of ours made a videotape of this broadcast and sent more than 50 copies to interested parties). The payload compartment cracked on impact, and the transmitter, as well as the camera, got soaked, but they were operating again after the batteries were replaced!

On other occasions we also tested "pinhole" cameras. We used an IR-responsive CCD camera in combination with a power regulating kit. It can operate in bright light or darkness and produces black and white images of a lesser resolution. These pictures are, of course, not as spectacular as the ones from the color camera, but the system is smaller and less expensive. Once you fly rockets, you have to start to think about the risks involved for your expensive payload section.

Both cameras allow for either vertical or horizontal mounting since they are compact enough to fit within a regular four-inch diameter body tube. Once we used a mirror, rotated by 45°, and therefore allowing the camera to look outside during ascent. The mirror was dropped at apogee and the camera then continued to look straight down while descending under the parachutes. Although this worked, it adds to the complexity of the overall construction of the vehicle. Experience shows that, in rocketry, the best solutions are the simplest ones. There are still plenty of things you never *considered* that can and will go wrong. Murphy shows no mercy.

Since the batteries have a rather limited lifespan, it is essential to be able to turn the whole system on and off at any time. We used microphone jacks, which allow current to flow, when no plug is inserted. The jacks were mounted towards the outside of the body tube so that we were able to insert and remove the plugs at any time. For aerodynamic reasons, jacks are also the better choice, when mounted on the outside.

The ground equipment consists of a TVC-4G GaAsFET 70 cm ATV downconverter from PC-Electronics, which converts the 426 MHz frequency to channel 4 on a regular TV set. A normal HF cable runs from the converter to your portable TV set, which ideally has a built-in video recorder. The EB-432 ("Eggbeater") antenna with the RK-70 cm radial reflector kit from M2 is perfectly capable of receiving the downlink. In comparison tests with multiple receiving stations of the same flights, we were able to discover that the best antenna strategy would be to follow the flight path with the antenna on the ground rather than just have it sit on a high pole (although the differences were rather minor). Critical for the ground equipment is a stable 12 V power source. For redundancy we normally set up two independent ground stations, one working off a car battery and one working off a power generator using 110 VAC. We made comparison tests with different ground antennas, including amplified ones, but the Eggbeater seems to be good enough to receive the signal from the powerful transmitter. None of the other receiving ground stations had significantly better reception.

However, we were able to spot a difference in the reception quality of the TV sets. It appears that older black and white TVs have better receivers built-in than today's color TVs. These differences were most notable during ground tests. Once the vehicle was airborne, however, these differences disappeared as the quality of the picture drastically improved. This was due to the antenna setup and the interference created by the transmitter. Although the results were certainly pleasing, they would not suffice to do any scientific aerial photography.

That is why we also add a SLR camera to the payload section, which we control remotely through a standard R/C system. The ATV system allows us, via the live feed, to pick the best moment to shoot the SLR picture.

Photo E. Seconds before touchdown. The parking lot, the launch area and the visitors' house are visible on this shot looking straight west.

Since a rocket is always in motion, including the descent time under the parachutes, it is difficult to get very sharp pictures. However, there are always moments during which the payload section does not swing or move and still shows some interesting objects on the ground. During these moments, nearly perfect shots can be achieved with the remote control following the ATV's eye. 73

High Impedance Analog Volt/Test Meter

Here's a useful gadget to build while you wait for spring!

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

With technology speeding toward digital, analog instruments have been left behind. Digital has improved our ability to obtain accurate measurements from electronic circuits, so how can you miss with digital accuracy? Perhaps you can't miss if a specific measurement value is of concern, but there are occasions when an analog display is more indicative of a circuit response where a numerical digital indication can be confusing.

An S-meter indicating a received signal level is an example of a desired analog function that is not satisfied very well with a digital display. Tuning adjustments in transmitters and receivers create analog responses that need to be "observed" with an analog meter function, not digital. Although a digital display indicates the response, following the rolling digits is a little tough. Now may be the time to restore the capability for monitoring and displaying an analog function or response.

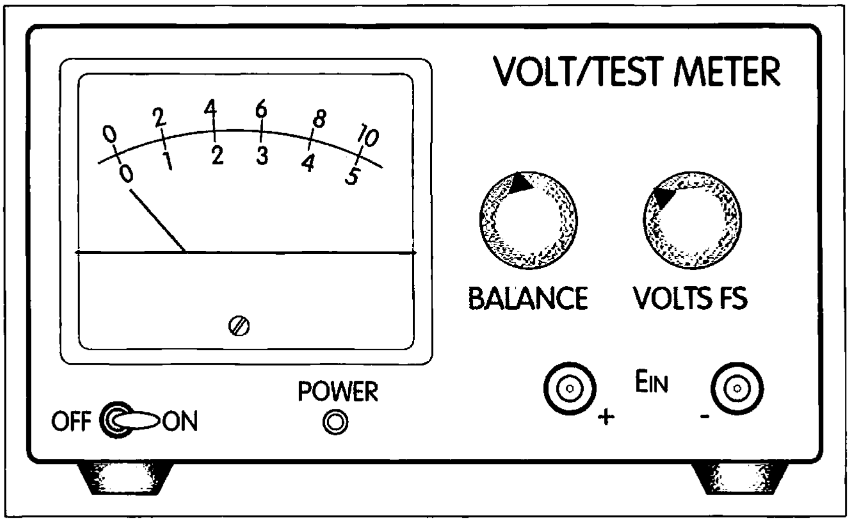


Fig. 1. Panel view of the Analog Volt/Test Meter. The small circle under the meter is the power LED.

If you've given up your analog meter, then the project described here is for you. **Fig. 1** shows the front panel layout using a square meter.

It is a simple instrument to build, and being a general-purpose meter, its characteristics have deliberately been changed from the typical analog voltmeter where a stepped range switch has been used. For this instrument, a potentiometer has been used to provide a variable control over the range and input sensitivity. The meter pointer may be set conveniently to any desired starting point and then moved, as necessary, when using the instrument for monitoring an analog function. Calibration of the range pot will vary with the pot selected for use. But in all cases, the markings are only approximate.

Should the instrument be used for measuring DC voltages, the full scale value can be set using a digital voltmeter. After setting the full scale value,

the meter response will be linear and will track the scale markings reasonably well.

I wanted to develop a solid state VTVM-style instrument to obtain an analog response suitable for monitoring an analog circuit function, and possibly use the instrument as a DC voltmeter. The results?

- One megohm input impedance to minimize circuit loading
- Low frequency bandwidth
- Variable input sensitivity
- One volt full scale (FS) sensitivity
- Both left and center pointer zero set is available using the balance control
- The circuit will accommodate a meter movement from 50 µA to 1 mA (by adjusting some values)
- Meter responds in a manner similar to a VTVM's
- The meter exhibits the accuracy/linearity of the basic meter movement when used as a DC voltmeter

The circuit

An LM741 op amp provides the foundation of the Analog Volt/Test Meter, as shown in **Fig. 2.** The input impedance of the LM741 is relatively low, requiring an FET input stage to increase the impedance value. However, the transfer curves of a JFET are nonlinear, which creates a nonlinear calibration response when a linear response is needed. To correct the situation and create a linear response, it is necessary to raise the op-amp gain sufficiently to allow operation over a very narrow portion of the FET curves. The resulting circuit response appears to be at least as linear as the meter scale markings. Any remaining nonlinearity in the FET response is transparent to the user.

After experimenting with several gain values, the op-amp gain was set at 1.2, which appeared to provide a sufficiently linear response when using a 0.5 mA meter movement. The circuit will accommodate most any meter current value from 50 µA to 1 mA, but it may be necessary to select a different gain value to accommodate a desired meter response when the meter current approaches or exceeds 1 mA. However, it is suggested that the gain remain at a value less than 2. Typically, the resistance value of R6 is the only value that needs to be changed in order to achieve a full scale meter movement for the selected meter. The value of R6 is selected by experimentation, using the following procedure:

- Connect the selected meter to the circuit.
- Set the input range pot to max sensitivity (full CW position).
- Apply 1.0 VDC to the input terminals.
- Adjust the value of R6; a 250 k pot may be used temporarily, until the meter pointer barely exceeds the full scale meter value.

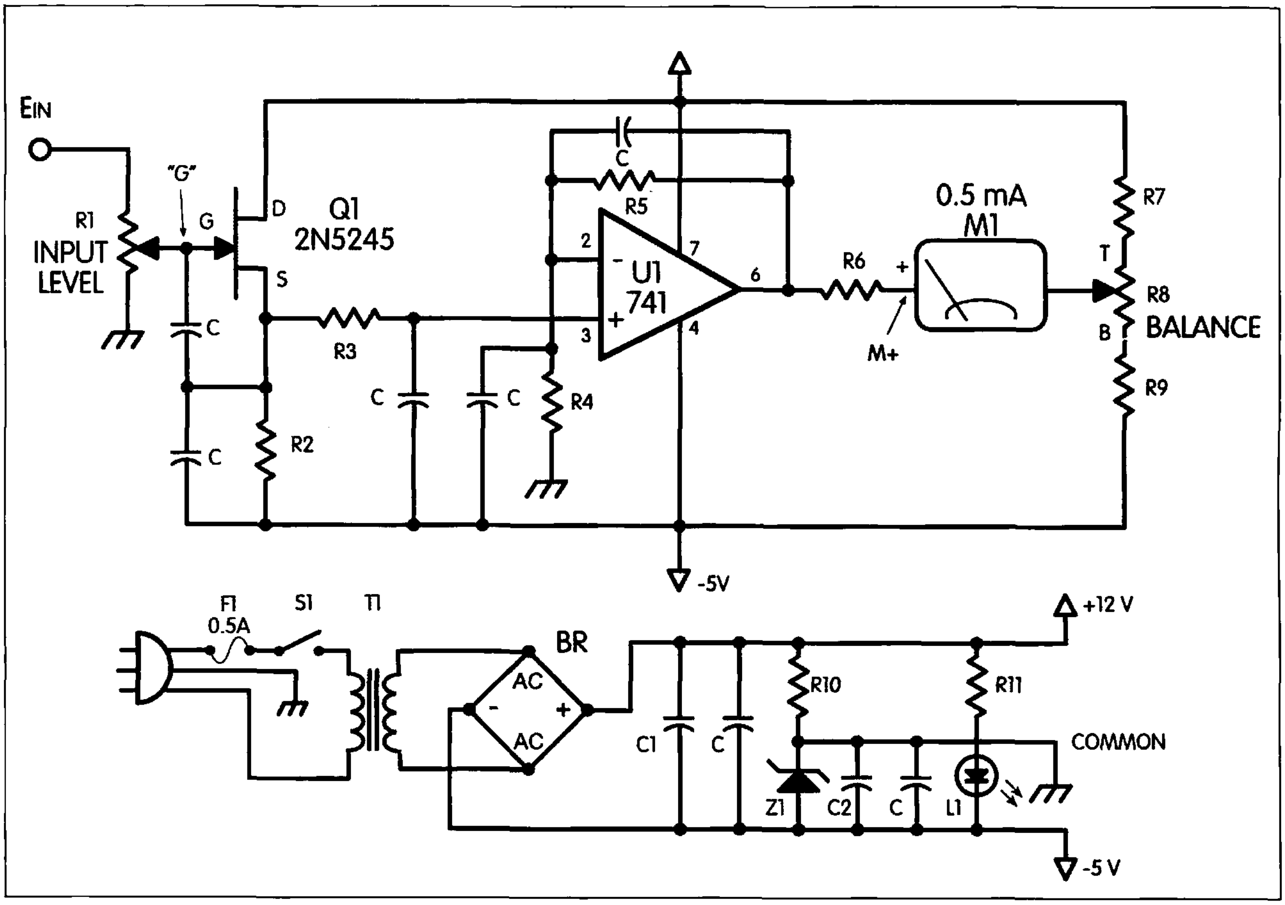


Fig. 2. Schematic diagram of the Analog Volt/Test Meter.

Parts List

R1	1 M pot
R2*	1.2 k 1/4 W
R3	22 k 1/4 W
R4	100 k 1/4 W
R5	120 k 1/4 W
R6*, R7	2.2 k 1/4 W
R8	1 k pot
R9	1 k 1/4 W
R10	240 Ω 1/4 W
R11	1 k 1/4 W
"C"*	0.005 µF – 0.1 µF 15 V disc cap
C1	330 µF 25 V radial cap
C2	47 µF 6 V radial cap
BR	any 0.5 – 1 A bridge rectifier
F1	1/8 – 1/2 A minifuse
L1	LED power indicator
M1*	0.5 mA 2-1/2 inch square meter
S1	miniature power switch
T1	12.6 V @ 0.3 A power transformer (RS #273-1385A)
U1	LM741 op amp & 8-pin socket
Q1	2N5245 JFET or equivalent
Z1	4.7 – 5.2 V 1/4 – 1/2 W zener diode

Cabinet (RS #270-253A)
Input terminals/jacks of choice
Power line cord
Standoff bushings for board mounting
Printed wiring board or equivalent
* See text

***Table 1.** Parts list.*

• Measure the pot's resistance value and select a fixed resistor value close to, or slightly less than, the pot's measured value.

• Tack the selected resistor into the R6 location and repeat this procedure.

Note: With the fixed resistor installed, the input range pot may be adjusted downward (CCW) slightly, to position the pointer exactly at the full scale value when 1.0 VDC is applied to the input terminals.

Calibration markings for the range pot are performed by applying a known full scale voltage value to the test terminals and adjusting the range pot to obtain a full scale indication. After marking the full scale voltage value on the panel, the range pot is positioned to a full CCW position before the next and higher input voltage is applied.

Construction notes

• The Analog Volt/Test Meter may be mounted in any suitable box or cabinet, as there are no critical parameters other than some RF susceptibility. Any wiring technique is suitable. The size of the meter movement dictates the actual cabinet size required. A two and a half-inch square meter was used in the prototype. As shown, the instrument was mounted in a Radio Shack™ #270-253A cabinet.

• Many bypass capacitors have been used throughout the circuit. These are marked simply as "C" in Fig. 2.

• Any disc ceramic capacitance value between 0.005 µF to 0.1 µF is suitable. The capacitors are used in an attempt to reduce the instrument's susceptibility to RF energy. The capacitors help, but unfortunately they do not correct all of the RF sensitivity problem. Therefore, some caution must be exercised when operating the instrument in the presence of a strong RF field.

• Though a 2N5245 JFET was used in the prototype, almost any JFET will work in the input circuit. It is suggested that a family variant of the 2N5245-48, an MPF102, or a 2N4416 be used as an alternate for the 2N5245. Regardless of the JFET selected for the project, the value of resistor R2 may require adjustment. The value of R2 is adjusted to obtain a near-zero voltage differential between the JFET terminal "S" and "COMMON" (JFET "G" is tied temporarily to "COMMON" for this test).

Try it!

The Analog Volt/Test Meter fills the gap created by the advancement of digital measurement techniques, which have pushed analog instrumentation into the background. There *is* still a need; build the Analog Volt/Test Meter and restore analog response measurements to your workbench. 73

Amazin' Hall Tree Vertical

Grab your coat and take your hat ...

Burt Syverson K5CW
3401 Garner Lane
Plano TX 75023

The antenna usually poses a real dilemma for the HF operator who wishes to take his radio with him when he travels by means other than automobile. There are a myriad of questions. What about luggage restrictions? Will there be any natural supports for a horizontal wire, and if there are, will it be necessary that you emulate a mountain goat or steeplejack to use them?

A vertical antenna seems like a good alternative. However, there is the possibility of receiving a bloody nose if a passer-by gets inadvertently entangled in your ground radials.

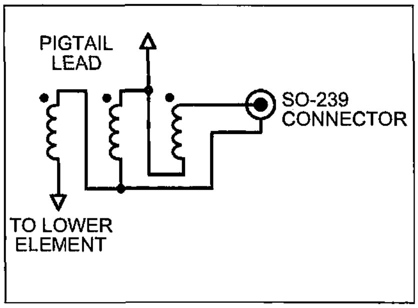


***Fig. 1.** 50- to 50-ohm balun (one required). Ten turns #18 Formvar™ trifilar wire wound on Amidon Associates™ ferrite toroid FT-140-67 form.*

The vertical loop seemed like a good possibility to me. I built the one described in the May 1994 issue of *QST* (even though it would not fit in a suitcase and I had doubts about it). I tried it running QRP, with very poor reports on 20 CW (nothing better than 5/5/9). I felt that there must be something better.

A friend of mine, who owns Electronic & Parts Outlet in Richardson, Texas, asked me if I knew of any use for 38-inch, swivel-base, telescoping whip antennas, as he had a real "crowd-stopping" price on them. The wheels started to turn, and I came up with what I call the Hall Tree Vertical. This is because it gives you the urge to hang up your hat or coat when you look at it. It requires no radials, is self-supporting, operates 10 through 20 meters, is easily transportable (it weighs only approximately 11 pounds in its four-foot gun carrying case), is relatively inexpensive to build, and performs quite well for its size.

Electronically, it is a centerfed vertical half-wave antenna with inductive loading. A 1:1 50-ohm balun at the feedpoint reduces interaction between the feedline and the radiator as well as has other benefits, e.g., the ferrite core is somewhat lossy in the VHF-UHF frequency region, and therefore reduces harmonics which could cause television

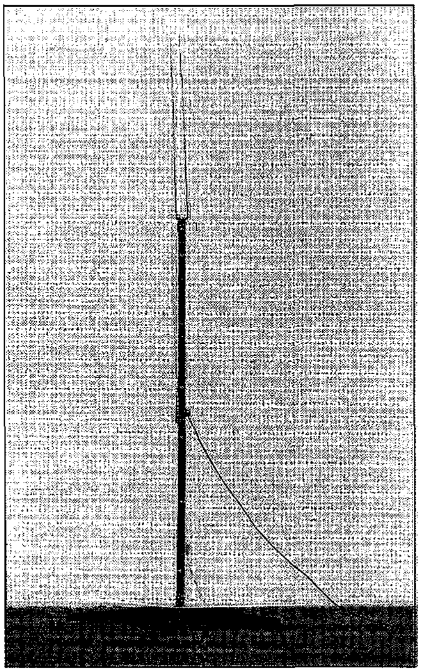


***Photo A.** Hall Tree Vertical in use—metal foot extensions (folded underneath) can't be seen. Note both top and bottom whips. Photos by Peg Syverson.*

interference. Also, by reducing antenna currents in the feedline, it eliminates unwanted currents, making it easier to obtain a minimum SWR, which is done by adjusting the telescoping elements. Band selection is made by changing connections on the loading coils.

The antenna support is the familiar Christmas tree stand design. It is made from two 1- x 4- x 46-inch pieces of crisscrossed pine. Each corner has a 1/8- x 1/2- x 18-inch piece of steel, mounted with a single screw, that can be extended in windy conditions. The mast is made from 1- x 2-inch pine. The lower section is 46 inches long. The top section is 41 inches long. The two sections are hinged at the center.

The top section contains two telescoping 38-inch whip antennas, loading coil, and 37-inch piece of 3/4-inch copper tubing. The tubing is flattened and a binding post is mounted on the lower end. The lower section has the balun and SO-239 connector mounted at the top end with another 37-inch piece of copper tubing, loading coil, and two more whip antennas at the bottom. The lower section is held to the base by two 3-inch carriage bolts and wing nuts. Two screw eyes in each

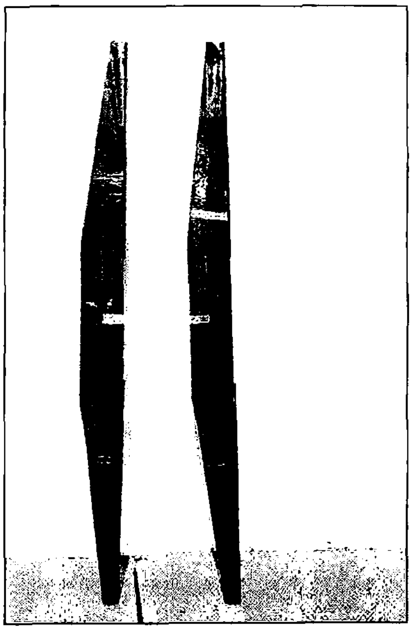


Photo B. Christmas tree stand base sections with metal extensions partially visible.

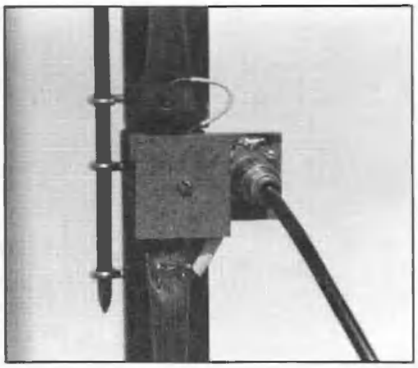


Photo C. Feedpoint in operation.

section on either side of the hinge and a 60-penny nail hold the two sections erect when in use.

The swivel base antennas present a mounting problem because they have metric threads. They are paired and tied together electrically, so there are several possibilities; the antennas I use are cheap, but they're made for mounting in a slotted hole with a metric-size mounting stud. Every constructor may not be equipped to do things the same way I did, depending on such various factors as mechanical experience, access to a machine shop, variety of stock in the local hardware store, etc. It may not be truly universal, but I would suggest that a 1/2-inch x 1/16th-inch piece of sheet metal could be bent into a "U" shape, with a base drilled with two #28 (or 1/8th-inch) holes for fastening it to the mast with #6 round-head wood screws. The sides of the "U" should be approximately 5/8-inch long and drilled to the clearance size of the antenna mounting studs. Solder lugs with a short connecting lead can be used on each stud for making electrical connection to the loading coils.

Powdered iron toroid cores are not customarily used in antennas. These cores have limited power handling

Photo D. Feedpoint folded for shipment.

Parts List

Qty.	Description
4	70 Telescoping Antenna from EPO
1	8-foot length of 1x2 pine
1	8-foot length of 1x4 pine
10 ft.	3/4" copper tubing
4	1-1/2 foot x 3/4 inch x 1/8 inch steel strips
1	Ferrite toroid (FT-140-67)
2	Powdered iron toroid (T-106-6)
40 ft.	#18 copper magnet wire
1	2-inch hinge
1	SO-239 coax connector
1	Binding post
6	1/2-inch Nylon cable straps
4	3/8-inch Nylon cable straps
12	#6 3/4-inch RH wood screws
3	#6 2-inch RH wood screws
4	#8 1-inch RH wood screws
4	#4 – 40 x 3/8 RHMS
12	#6 – 32 x 3/4 RHMS
4	#4 lockwashers
24	#6 lockwashers
8	#8 flat washers
4	#4 – 40 nuts
24	#6 – 32 nuts
2	1/4 – 20 x 2-inch carriage bolt
2	1/4 x 20 wingnuts
1 ft.	1/4-inch copper tubing
4	Screw eyes
1	60d nail

Misc. (Carrying case, paint, solder, partial sheet of 1/4-inch Masonite)

Table 1. Parts list.

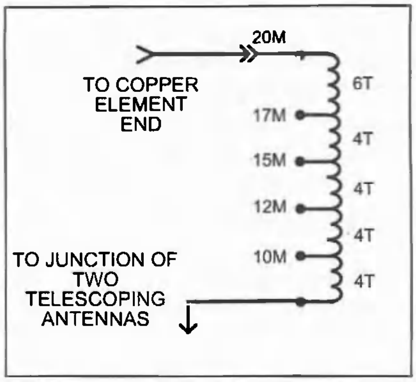


Fig. 2. Loading coils (two required). #18 Formvar wire wound on Amidon powdered iron toroid T-106-6.

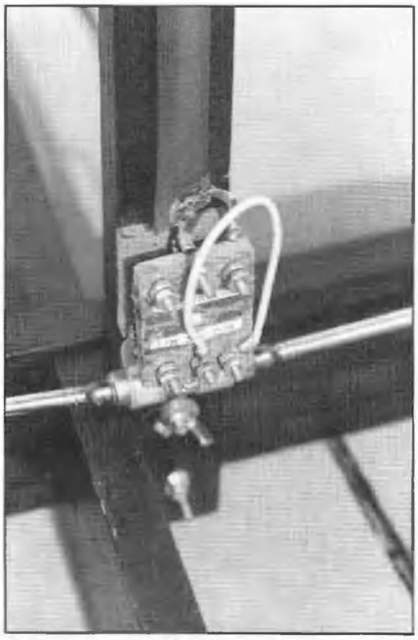


Photo E. Lower loading coil, showing #6-32 hardware with jumper for band changing. Lower elements horizontal when in operation.

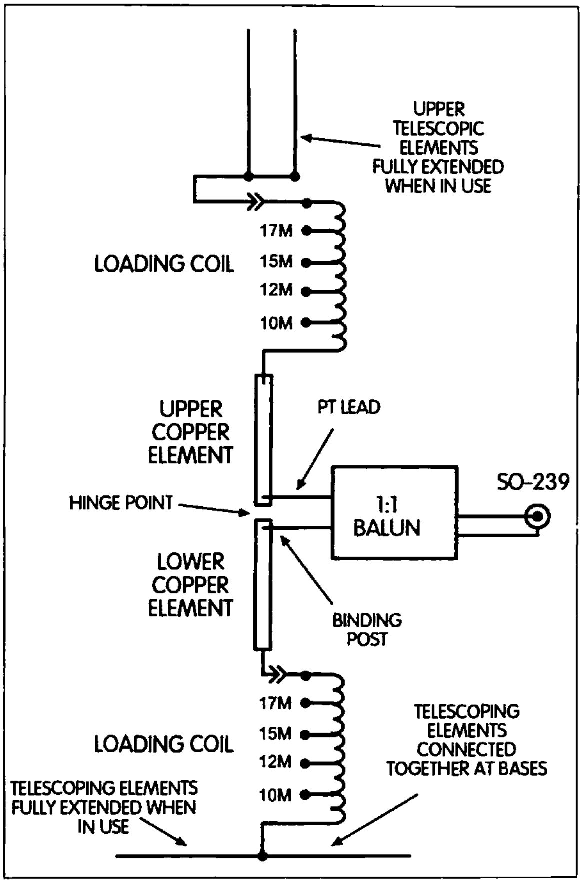


Fig. 3. Complete diagram.

capability. Because the ends of the windings are in close proximity to one another as well as to the core, there is danger of a high-voltage flashover as well as damage from overheating if the input power is raised too far. However, this antenna was designed to be a QRP antenna; it was not intended to be used over the 100 W level. Discernible heating or arc-over has not been experienced. The powdered iron toroid cores' high "Q" contributes to the antenna's efficiency.

Replacement 38-inch, swivel base, telescoping whip antennas are a common item at hamfest and surplus stores. In operation, the upper telescoping elements are fully extended vertically to 38 inches (except on 10 meters where a better SWR is usually obtained at 31 inches). On all bands, the antenna is resonated by adjusting the lower elements horizontally, equal lengths together for minimum SWR. Coupling a dip meter through a two-turn loop (between the inner conductor and the shell of the SO-239—the feedline is temporarily disconnected) can be used to

Continued on page 79

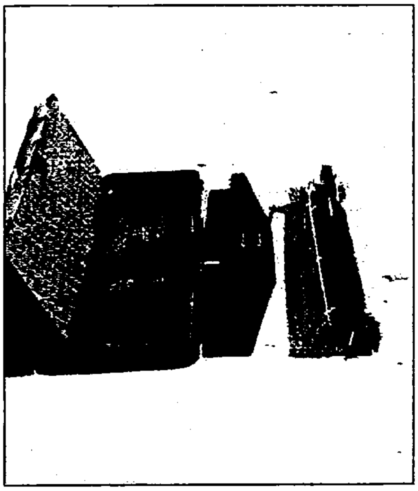


Photo F. Ready to pack and go. Leave your worries on the doorstep ...

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the June issue, we should receive it by March 31. Provide a clear, concise summary of the essential details about your Special Event.

MAR 1

NEW WESTMINSTER, BC, CANADA The Burnaby ARC's 11th Annual Fleamarket will be held at New Westminster Armouries, 6th Street and Queens Ave., New Westminster BC. Open to sellers at 9 a.m., open to buyers 10 a.m.–2 p.m. Talk-in on VE7RBY 145.35(-), or 442.85. Contact by telephone, between 7 p.m. and 9 p.m. PT, *Harry VE7HNC, (604) 530-3962; Graham VE7ABC, (604) 530-1907; or packet VE7ABC @VE7KIT.*

MAR 7

ABSECON, NJ The Shore Points ARC will sponsor its 16th annual hamfest, "Springfest '98," at Holy Spirit High School on Route 9, 3/4 of a mile south of Route 30, starting at 8 a.m. Admission is $5 (non-ham XYLs and children free). Indoor tables (limited AC available) are $7 per 8-foot section in advance, $10 at the door. Reservations will be accepted. Outdoor tailgating (weather permitting) is $5 per painted parking space (first come, first served, no reservations accepted). Setup at 6:30 a.m. Free parking. For info write to *SPARC, P.O. Box 142, Absecon NJ 08201; or call Eva KB2QXU at (609) 407-2923.* Talk-in on 146.385/.985, PL 146.2 Hz.

ROSEVILLE, MI The L'Anse Creuse ARC will hold its 3rd annual Amateur Radio Open House at the Macomb Mall in Roseville MI, for the purpose of introducing ham radio to the public. As part of the demonstration, the club will operate station N8LC, 1500 UTC–2100 UTC, and will invite visitors to join them on the air. Voice operation will be in the General portion of the 40 and 20 meter bands. Listen for them on or near 7230 on 40 meters, and 14.330 on 20 meters. Anyone who contacts the station can receive a commemorative certificate. Send a QSL card and SASE to *N8LC, c/o Diane Scalzi, 21621 Briarcliff, St. Clair Shores MI 48082-1299.* Please include a 9-inch x 12-inch envelope with 64 cents postage if you want an unfolded certificate. Otherwise, send a business-size envelope with 32 cents postage.

MAR 14

KNOXVILLE, TN The Shriners of the Kerbela Amateur Radio Service will sponsor the Kerbela Hamfest at the Kerbela Shrine Temple in Knoxville, 8 a.m.–4 p.m. Admission is $5. Indoor vendor tables are $8 each, plus admission of $5. Setup Fri., 4 p.m.–8 p.m. and Sat., 5 a.m.–8 a.m. Overnight security provided. Talk-in on 144.83/145.43 or 146.52 simplex. Smoking indoors permitted in designated area only. For additional information contact *Paul Baird K3PB, 1500 Coulter Shoals Circle, Lenoir City TN 37772. Tel. (423) 986-9562.*

MAR 14–15

MIDLAND, TX The Midland ARC will hold their annual St. Patrick's Day Hamfest 9 a.m.–5 p.m. Sat., March 14th, and 8 a.m.–2:30 p.m. Sun., March 15th, at the Midland County Exhibit Building. This is also the ARRL West Texas Division convention. Some of the many features include a huge inside flea market, dealers, large tailgate area, T-hunts, and more. VE exams will be given at 1 p.m. on Sat. Pre-registration is $7. Registration at the door will be $8. Tables $12 each for the first four and $17 each for each additional table over four. For more info, contact *Midland ARC, P.O. BOX 4401, Midland TX 79704;* or *Larry Nix N5TQU, by E-mail [oilman@lx.net].* You can see the Hamfest flyer and download a registration form at *[http://www.lx.net/edge/midswap.html].*

MAR 14, 21, 28; APR 4

CLAYTON, MO The annual St. Louis County SKYWARN Severe Weather Observation Training Seminars will be held on the Saturdays listed above. For locations call the *Severe Weather Info Line, (314) 889-2857.* You will get a taped message and additional information. All are welcome, including those from outside the area; no advance registration required. Free parking. SKYWARN Level 1 training is presented in the morning, and classes resume in the afternoon with the SKYWARN Level 2 program. Certification is provided for RACES and SKYWARN, all at no cost. One need not be a ham operator to attend and participate in the program. Please call for additional information.

MAR 15

JEFFERSON, WI The Tri-County ARC "Hamfest 1998" will be held at the Jefferson County Fairgrounds Activity Center, Hwy. 18 West, Jefferson WI, 8 a.m.–2 p.m. Admission is $4. 6-ft. table space, $5; 8-ft. space, $6. Reserve space early. Send your SASE to *TCARC, W9MQB, 711 East Street, Fort Atkinson WI 53538. Tel. (920) 563-6502.* An equipment test table will be available. Vendors will be admitted at 7 a.m., others at 8 a.m. Vendors: Please unload at the northwest side door; parking will be provided for unloading. No early sales. Talk-in on 145.49 rptr.

MAUMEE, OH The Toledo Mobile Radio Assn. (TMRA) will hold their 43rd Annual Hamfest/Computer Fair, 8 a.m.–3 p.m., at the Lucas County Recreation Center, 2901 Key St., in Maumee. For details send SASE to *TMRA/Paul Hanslik, P.O. Box 273, Toledo OH 43697-0273;* or call Paul N8XDB at *(419) 243-3836.*

STERLING, IL The Sterling-Rock Falls ARS 38th Annual Hamfest will be held at the Sterling High School Field House, 1608 4th Ave. There will be a large indoor flea market, radio, electronic items, computer and hobby gear. Free parking, including areas to accommodate campers and self-contained mobile homes. Dummy load available to test equipment. Tickets $3 in advance, $4 at the door. Tables $5 without elec., $6 with. First table is $6, each additional is $5. Bring your own power cord. Setup Sat. 6 p.m.–9 p.m., and on Sun. at 6 a.m. Doors open to the public at 7:30 a.m. Sun. For advance tickets and tables, write to *Sterling-Rock Falls ARS, P.O. Box 521, Sterling IL 61081-0521;* or call *Lloyd Sherman KB9APW at (815) 336-2434. E-mail: [lsherman@essexl.com].* Make checks payable to *Sterling-Rock Falls Amateur Radio Society.* Talk-in on 146.25/.85 W9MEP rptr. Advance ticket orders must be received by Mar. 1st. Please send an SASE.

YORK, PA The York Springfest will be held 8 a.m.–3 p.m. at York County Vo-Tech School, 500 yards south of Exit 6, I-83. Tailgating, VE exams, and a Hamfest/Computer Show will be featured. Admission is $5. The event is sponsored by the Keystone VHF Club. Contact *Ted Rodes, 17 Sedgwick Dr., East Berlin PA 17316. Tel. (717) 259-8063. Web page: [http://members.aol.com/yorkfest].*

MAR 21–22

BETHPAGE, NY The Long Island Mobile ARC will present a weekend Ham Radio Course at Briarcliffe College, 1055 Stewart Ave., Bethpage NY, Sat., Mar. 21st–Sun., Mar. 22nd, 9 a.m.–6 p.m., for anyone interested in obtaining their entry level amateur radio license. There is no prerequisite for registering—just a desire to become a ham. No minimum age limit, but we recommend age 10 and above. The cost per person is $35. This includes the workbook, lunch each day, and refreshments at breaks. It does not include the exam cost of $6.25. There will be a number of instructors, including LIMARC Past President Norm Wesler K2YEW, current LIMARC President George Tranos N2GA, and current Vice President Rob Todaro N2JIX. For more info, please call the LIMARC 24-hour info line at *(516) 520-9311;* or

E-mail to [N2GA@aol.com]. Registration is limited, so please reserve now to secure your spot. Indicate age if less than 18. Please make checks payable to *LIMARC* for $35 per person. Include name, address, phone, and E-mail address. Send to *LIMARC Weekend Class, P.O. Box 392, Levittown NY 11756.*

MAR 22

GRAYSLAKE, IL The Libertyville and Mundelein ARS, assisted by the North Shore Radio Club, will hold "LAMARSFEST '98" at the Lake County IL Fairgrounds in Grayslake. This large, indoor, radio, computer, and electronic swapfest will be open 8 a.m.–2 p.m.; setup is at 6 a.m. Advance commercial setup by arrangement. Admission is $5 at the door. Swapfest tables $10 each. Wall tables $15 each. Commercial tables $25 each. Table reservations until March 14th. No additional charge for power. VE exams. No tailgating. For info and reservations, contact *Dave Gudewicz KB9KDA, LAMARSFEST 98, 5 Brigantine Lane, Grayslake IL 60030. Tel. (847) 937-8227 until 9 p.m.* Talk-In on 147.945/.345 NSRC rptr., and 146.52 simplex.

MADISON, OH The Lake County ARA will hold its 20th annual Hamfest 8 a.m.–2 p.m. at Madison High School on North Ridge Rd. in Madison. VE exams, DXCC and WAS checking, ham-related forums, and a test bench are some of the features of this event. Admission $5 at the door. Table space for vendors is $8 for a 6-foot table and $10 for an 8-foot table. Reservations for tables can be made by calling *Roxanne at (440) 256-0320.*

YONKERS, NY The Yonkers Raceway will be the location for the Westchester Emergency Comm. Association's annual radio and electronics hamfest. This indoor and outdoor event will feature all types of new and used ham radio equipment, computers, CB, shortwave, scanners, and other varieties of electronic equipment and parts for sale. Major equipment dealers, VE exams, radio forums, a radio tech clinic, and tailgating will also be featured. Free unlimited parking. Handicap accessible. Admission is $6, children under 14 free with adult admission. For more info please call the WECA info-line at *(914) 741-6606*, or visit the WECA Web site, [WWW.WEC.*ORG]*. Talk-in on the WECA rptr. on 147.060 MHz, +600 Hz, PL 114.8.

APR 3–4

ATLANTA, GA The 2nd Southeastern VHF Society Conference will be held Fri. and Sat., April 3rd and 4th, in Atlanta GA. Antenna measurements will be done on Friday, starting with 144 MHz and working up in freq., amateur bands only, please. A maximum of two antennas per band per individual may be tested. Please supply a Female N connector or SO-239. Please pre-register. For more info, contact *Antenna Measurements Chairman Dale Baldwin WBØQGH at [wbØqgh@mindspring.com]*. Noise Figure Testing will be conducted on Saturday. For more info, contact the *Noise Figure Measurement Co-Chairman Charles Osborne WD4MBK, at [cosborne@pipeline.com];* or *Fred Runkle K4KAZ at [engineer@rightmove.com].* There will be a Friday evening flea market, a Saturday evening banquet, SVHFS auction, and family program. Register before March 14th and receive a discount! You are invited to visit the Web site at *[www.akorn.net/~ae6e/svhfs].*

APR 4

WATERFORD, CT A Ham Radio Auction, sponsored by the Radio Amateur Society of Norwich, will be held at 10 a.m. at the Waterford Senior Center on Rt. 85. From Hartford, take Rt. 2 south to Rt. 11 to Rt. 85 South. From the shoreline, take Rt. 95 to Rt. 85 North. Talk-in on 146.730(-). Bring your gear to sell (10% commission to RASON). Free admission, free parking. Contact *Tony AA1JN at (860) 859-0162;* or see the RASON Web page at *[www.ims.uconn.edu/~rason].*

APR 5

MIDDLETON, WI The Madison Area Repeater Assn., Inc., will hold its 26th annual Madison Swapfest at the John Q. Hammons Trade Center in Middleton. Take Hwy. 12 (the Beltline) west of Madison and exit westbound on Greenway Blvd. Commercial exhibitors and vendors with 6 or more flea market tables will be admitted beginning at 1 a.m.; other flea market sellers will be admitted at 6 a.m. Doors open to the general public at 8 a.m. New and used electronics gear, from computers to communications equipment, will be on sale. Lots of parts for the electronics hobbyist will also be on hand. Free parking. Hotel accommodations available at the adjoining Marriott Hotel, as well as at several nearby hotels. Talk-in on the MARA rptr, W9HSY, on 147.75/.15. Admission is $5 per person in advance, $6 at the door. Children under 10 admitted free. 2.5-foot x 6-foot flea market tables are $15 in advance, plus admission. Reserve early. Reservation deadline is March 28th. For tickets, tables, or spaces, write to *MARA, P.O. Box 8890, Madison WI 53708-8890 USA. Tel. (608) 245-8890.* Visit the swapfest Web site at *[http://www.cs.wisc.edu/~jeremyc/mara/swapfest/].*

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their Hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

MAR 21

MACON, GA The Macon ARC will operate W4BKM 1500-2300 UTC, at the 16th annual Cherry Blossom Festival in Macon GA. Phone, 7.235, 14.240, and 21.335; CW, 7.135, 14.035, and 21.135. For a certificate, send your QSL and a 9-inch x 12-inch SASE to *Macon ARC, P.O. Box 4862, Macon GA 31208 USA.*

Number 36 on your Feedback card

Secrets of the 224

Inside MFJ's 2-Meter FM Analyzer™.

Peter A. Bergman NØBLX
3517 Estate Dr. SW
Brainerd MN 56401

How would you like to be able to check and set the deviation on your two-meter transceiver, or evaluate an antenna: gain, beamwidth, bandwidth, front-to-back ratio, and sidelobe suppression? Or map out a repeater's field strength? Maybe you got a heck of a deal on some coax and want to know what the loss really is. You're installing an antenna and you want to know which side of the tower is really the better spot. What is the real gain, in dB, of that new receive preamp? You're trying to find a hidden transmitter or jammer and the blinky lights on your rig just won't give you the signal strength information you need. Maybe you want to scan the two-meter band quickly to track an interfering signal. How would you like to get a look at the quality of the signal out of your rig? Does this sound like it will take a shelf full of expensive test equipment? Not so!

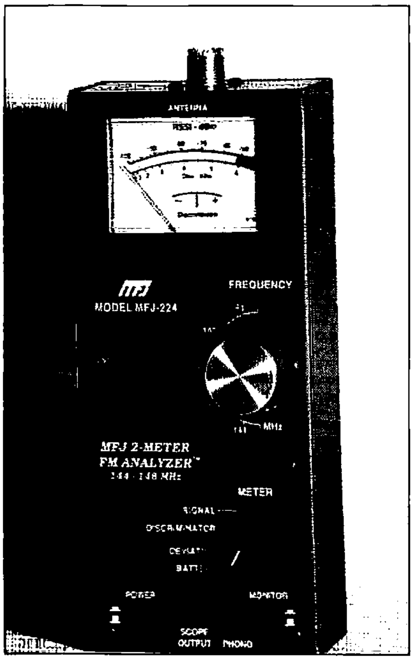


Photo A. *The MFJ-224 FM Analyzer. Photo by NØBLX.*

"It's not often that a new gadget makes a payoff so quickly, but the MFJ-224 did for me!"

Enter the new MFJ-224 2-Meter FM Analyzer™. The 224, designed by Rick Littlefield K1BQT, is, at heart, a tunable-oscillator two-meter receiver. What makes it so useful is the built-in meter and associated circuitry (**Photo A**).

The precision meter is three inches across and is calibrated to read received signal strength in dBm and deviation in kHz. It also has a discriminator scale and a battery condition scale.

On the bottom of the 224 there is an RCA jack for connecting the unit to an oscilloscope. A general-purpose scope will do fine since only audio signals are being observed. There is also a 1/8-inch phone jack which allows connection of a mono or stereo headset. The "Monitor" button turns on an internal audio amplifier to drive the headset to acceptable volume levels.

Once I had read the instruction manual and installed a fresh nine-volt alkaline battery (not included), I was ready to try the new MFJ-224. The 14-page manual includes a two-page "orientation" section, so that's where I started. After a few minutes of experimenting with the controls and listening to repeaters around the area it was time to put my new signal analyzer to work.

The first thing I did was to switch my two-meter rig to 146.52 with the output connected to a dummy load.

I fed the rig with a 1 kHz tone from an audio signal generator. If that hadn't been available I could have used the

sidetone from an HF rig or a code practice oscillator. Barring that, I could have used the test tone from a TNC.

Then, using the discriminator scale on the 224, I carefully tuned it to 146.52. Next, I switched to the deviation scale and keyed the transmitter while feeding the 1 kHz tone into the microphone. Oops! Overdeviation is a definite no-no, but my rig was a long way from over-*anything*. After increasing the deviation to a more reasonable level I found that I could hit repeaters that required the power amp before. It's not often that a new gadget makes a payoff so quickly, but the MFJ-224 did for me!

Next I connected the 224 to a quad beam I've been playing around with for a while. Although this five-element design is very popular and has been written up in a couple different ham magazines I thought more might be better. Sure enough, going to six elements seemed to help and adding a seventh seemed to help a bit more. I thought. I had been using over-the-air reports while trying to modify the design. The trouble with this is one fellow will give you a poor report when things are actually improving, and the next report, from someone else, will be pretty good. What you won't know at the time is that the first guy is a recording engineer who finds Brownian movement offensive. The second person entertains himself copying CW on 7.112 with an ARC 5 receiver. He can pull a full copy signal through a vault door so almost anything sounds good to him.

The 224 FM Analyzer confirmed my belief. More importantly, it made it possible to quantify the improvement each change made. The improved performance was not imaginary and I could determine when I had reached the point of diminishing returns.

Claims we hear about antenna gain are a lot like stories we hear about fishing and hunting. "Yhup, I got that 32-point buck at four hunnert yards, uphill, in the rain, with my trusty old thutty-thutty. Too bad I lost him durin' the earthquake on my way out of the woods." Or, "The Ozone Burner Juan 2000 rubber ducky will outperform ..."

Okay, let's get real

Whether you have a factory-made antenna or are rolling your own from scratch the MFJ-224 makes it possible to know, in real numbers, how that design works.

First of all, you will want to establish a standard against which to measure your new antenna. Let's say you want to check out that O B Juan against the old rubber ducky you've been using on your handheld. The old ducky is your standard, but switching antennas back and forth while driving around town asking for signal reports probably won't tell you much. There are too many variables. And it's dangerous.

You'll want an open area as free of RF reflections as possible. The center of four or five square miles of salt marsh would be ideal but you will probably have to settle for something less, like a trip to the park.

Next you need a signal to receive. Monitoring the local repeater is okay but not ideal. You will want as steady a signal as possible. Get a friend with a base station to transmit a steady tone, not voice, for your tests.

Once you have a "standard" antenna, the test antenna, an open area and a steady signal you are ready to perform some tests. Install the "standard" antenna on the FM Analyzer, switch to Discriminator and turn the tuning knob until the steady test signal centers the needle on the lower scale. Now switch to Signal and note the received signal strength on the top scale. Without changing anything else install the test antenna and note the received signal strength. The difference between the readings is the gain or loss, in dBm, of the antenna being tested.

When testing the quad I mentioned earlier a similar procedure was followed. The difference was that I used a vertical dipole as a standard against a quad loop. Then I added and removed elements and played with spacing on the test antenna and plotted those results. Now I have an antenna test range right in my own front yard. Sometimes I wish I lived across the street so I could

Continued on page 38

Secrets of the 224

continued from page 37

watch all the fun stuff that happens over here …

Suppose you are trying to pick the best spot for a Field Day antenna. The MFJ-224 can help you out there. Sometimes a few feet one way or the other can make a difference that is difficult to detect by ear alone.

If you add a small beam antenna to your 224 you can be into foxhunting in a hurry—or be able to track a jammer or problem kerchunker.

The MFJ-224 is an all-around handy unit. Besides the applications already mentioned, it can be used to map repeater field strength, measure preamp gain, analyze audio quality with a scope and tune low-power transmitter stages. Yes, it has enough coverage for MARS and CAP operators.

Although the FM Analyzer requires a light touch when tuning, the receiver has proven stable enough for all the applications I've tried, including monitoring. Operation is very easy to learn. The compact size (eight inches long by three and three-quarters inches wide by three and one-quarter inches deep, including projections) and light weight make the MFJ-224 very convenient on the bench or in the field.

Construction of the 224 is up to MFJ's usual high standard. Panel and meter markings are clear and easy to read. The case is held together with machine screws and threaded inserts, not sheet metal screws which loosen and quickly get lost. The vinyl-clad finish is both attractive and durable.

The instruction manual is 14 pages long, very comprehensive and easy to understand. It starts with the technical specifications, runs through a list of applications and operating instructions and ends with two pages of schematic and field service guide. If something does go wrong with your 224, MFJ is one of the few outfits that doesn't penalize you for trying to fix the unit yourself.

The MFJ 2-Meter FM Analyzer™ is a useful addition to the shack and, of course, it carries MFJ's one-year "No Matter What" unconditional guarantee.

For a free catalog and the name of your nearest dealer call MFJ at (800) 647-1800. The company can also be reached at MFJ Enterprises, Inc., Box 494, Mississippi State MS 39762. Telephone (601) 323-5869; FAX: (601) 323-6551; Tech Help: (601) 323-0549.

Never Say Die

continued from page 5

better plants you can grow. This ties in with the remineralization of Hamaker-Weaver.

Water

If you don't think fluorides in your drinking water are going to affect your body, try growing plants with that stuff. Ditto chlorine. Beyond providing plants with lots of pure water, if you can lower the surface tension of the water it will be more easily absorbed by the plants, making for faster, more healthy growth. You can do this by exposing the water to the north pole of a magnet or by adding some of Pat Flanagan's Crystal Energy to it. Crystal Energy is too expensive for farming, but can be used on house plants and humans.

There are several manufacturers of magnets for water pipes aimed at keeping the minerals in the water from sticking to the pipe, gradually clogging it. I'd like to see some tests of these used on water for plant growth. I'll be surprised if they don't help.

Hydroponics

Those huge gorgeous gift fruits they sell in the Japanese railroad station stores are grown hydroponically. If you've been to Epcot Center™ I hope you went through their special hydroponic garden exhibit. They grow most of the vegetables for the Epcot restaurants there.

Hydroponically grown fruit and vegetables are economical to grow and are superior in appearance, flavor, and nutritive value. They can be grown disease free, grown faster, and have better keeping qualities than most fruit and vegetables. Around 15 minutes a day spent gardening should feed a family using a 10- x 12-foot part of their backyard. You can read *Hydroponic Gardening* by Bridwell, which is $12 from Acres USA (#6182) to get all the details. You grow everything without soil.

Now Let's Suppose

What would happen if some enterprising person were to start combining these growth enhancers? Like using Sonic Bloom in a pyramid greenhouse, using

Continued on page 48

The ZenerMeter

A test set for zener and other diodes.

Larry G. Ledford KA4J
553-4th St. SE
Cleveland TN 37311
[KA4J@juno.com]

If you do any building of or repair work with electronic equipment, you soon acquire a VOM, scope, transistor tester, and cap meter. All are very useful, but they won't check out the one component found in most regulated power supplies and many other circuits: the zener diode. Granted, you can jury-rig a VOM, power supply, and enough clip leads to test the diodes, but if you are tired of a "lap work" work bench (where sparks and hot components fall into your lap), read on!

I was troubleshooting a Heath SB-220 amplifier with no bias. I suspected a zener that was connected to the same board on which the high voltage diodes were mounted. I didn't want to test the voltages with the high voltage present, so I built the ZenerMeter.

The ZenerMeter will let you identify the voltage a zener was designed for (up to about 30 volts). You can also test regular silicon, germanium, and light-emitting diodes (LEDs). Defective diodes can be detected, and the polarity of diodes shown. The zener capability of regular diodes and LEDs also can be identified.

The test set is a self-contained portable unit that is AC-powered and safe in use. It has a built-in voltmeter to read zener voltages and a set of jacks to allow connection to a digital voltmeter for very precise voltage measurement. A set of colored LEDs is used to identify diode polarity.

Referring to **Fig. 1**, you can see that the circuit to test the zener function consists of a 24-volt transformer-powered half-wave rectifier that when filtered supplies about 30 volts DC. This is connected across a 10 k pot used as a simple adjustable voltage divider. This voltage is fed through a 1 k current-limiting resistor to the zener diode under test. The diode is connected to the unit by way of two binding posts, one of which is grounded. A voltmeter is connected across the diode also to monitor the voltage. A parallel set of jacks allows you to connect a DVM (digital voltmeter) for a more precise voltage reading. As the voltage is slowly raised, a point will be reached at which the voltage across the diode remains steady as more voltage is applied. This is the zener voltage of this diode.

For the test of polarity, also called the GO/NO GO test, the binding post above ground holding the diode under test is switched to two colored LEDs connected in parallel (but in opposite directions) and coupled to the AC voltage at the center tap of the transformer through a 1 k current-limiting resistor. The AC voltage should be around 12 volts.

On each swing of the AC line, one of the LEDs will light if the diode under test will conduct in that direction. The voltmeter and the DVM jack are disconnected, as they are not needed in this test. Four different LED states identify either polarity of the diode, a shorted (or very leaky) condition, or an open diode.

I built my ZenerMeter into a old RCA VTVM case that I acquired for a buck at a hamfest. It's a good size, with plenty of room inside. The meter movement and the case were about all that I could use in the conversion but it saved money and a lot of hole cutting. Look around your junk box (room?) and see if you have some item you can convert. If not, the next hamfest will have something you can use. If you use an old VTVM case as I did, be sure the meter is okay. If the VTVM does not work as it should, that can be used as a lever to lower the price.

Start your construction by building the power supply. See what voltage you get across the 10 k pot. If you get

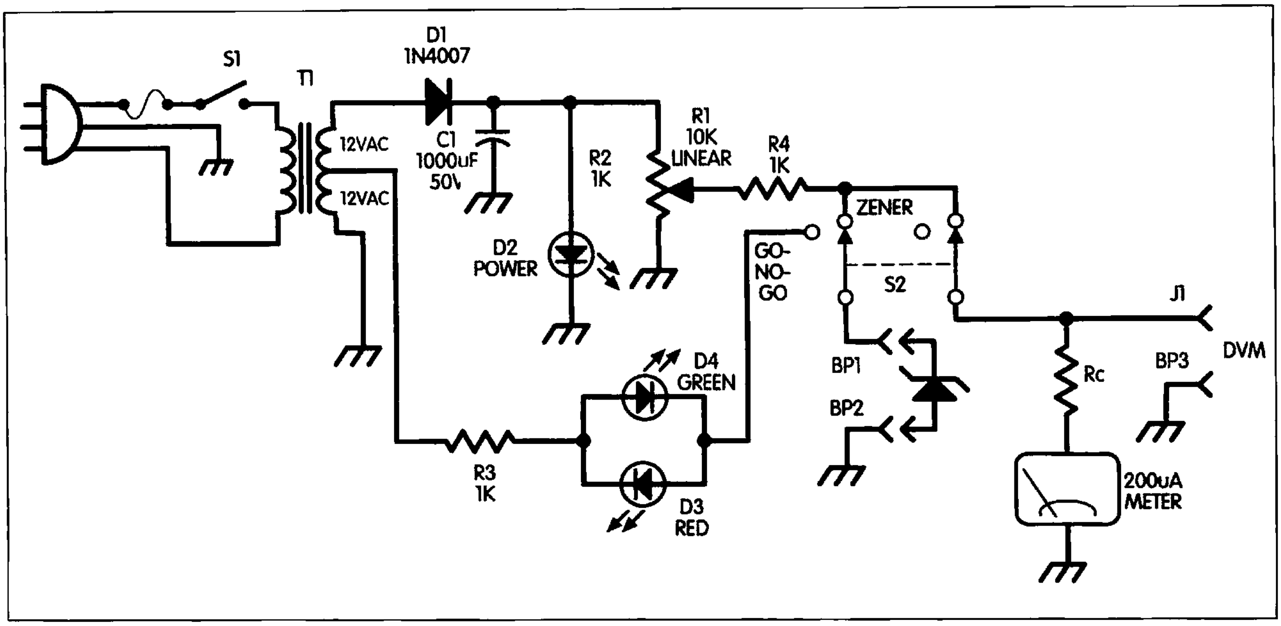


Fig. 1. Schematic.

25 to 35 volts, all is well. It's only important so you can determine what range your meter needs to read. You don't want to peg the meter if you turn the pot all the way up. Nor do you want all the reading bunched up on the low end of the range.

My unit had just under 30 volts, so I disassembled the meter and removed the metal faceplate. (Do this very carefully, making sure not to bend the pointer!) Using white correction fluid, I removed all the unneeded scales and modified the desired one (0–3 VDC) to read 0 to 30 VDC by covering the decimal places in the numbers. When the fluid dries, you can use a permanent marker to letter "Zener Test Set" and any other information you want on the faceplate. Very carefully reassemble the meter and mount it in place.

A better-looking meter front could be made by photocopying the old meter face, whiting out unneeded scales, and using an inkjet printer to make appropriate ones. Then you could Xerox™ the finished work onto a page of Avery label paper with adhesive backing. Just be sure that the added thickness of the paper doesn't cause the meter pointer to drag.

Mount all the other components except the two colored LEDs used in the GO/NO GO test. Temporarily tack these two LEDs (which are connected back-to-back) in place. Connect a known-to-be-good diode (1N400x—not a zener) with the cathode (banded end) to the grounded binding post and the other end to the above ground binding post. With power on, switch S2 to GO/NO GO. If the red LED lights, permanently solder the LEDs in place. If the green LED lights, reverse the LEDs in the circuit. Confirm that the red LED now lights and then permanently solder the two in place. These LEDs must be visible from the front panel. See **Fig. 2** for the layout I used.

Finish wiring the unit by connecting the meter through an appropriate multiplying resistor. The meter I used had a 200 microamp movement. I tried a 150 k ohm resistor as a multiplier and the meter read low. A 1 megohm resistor was placed in parallel with the 150 k and a 25 k trimpot was placed in series. This combination gave me the ability to adjust above or below the actual voltage. To calibrate the connected unit, place the unit in "Zener Test".

GO/NO GO CHART				
LED STATUS	TEST	CONNECTIONS		
		Zener	*Diode*	*LED*
Green	OK	Correct	Reversed	Reversed
Red	OK	Reversed	Correct	Correct
Both	Shorted or Leaky			
Neither	Open or High Voltage			
Your Name and Callsign				

Table 1. ZenerMeter GO/NO GO chart.

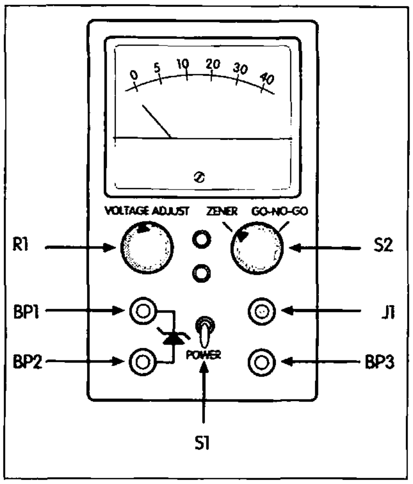


Fig. 2. Front-panel layout.

Connect a digital voltmeter of known accuracy to the DVM jack and turn the unit on. Turn the voltage up to near maximum and adjust the calibration pot until the meter reads the same as the DVM.

Parts substitution

Any diode with a PIV of 100 volts or more can be used for D1. The red and green LEDs used in the GO/NO GO test can be replaced with a tricolor LED with two leads, but not one with three leads (they cannot be connected back to back). C1 is not critical in value but must have a working voltage greater than the voltage coming from D1. T1 could have a bit smaller- or larger-voltage secondary. But too small and you won't be able to test higher-voltage zeners; too large, and it may destroy a diode. Current capability only needs to be about 40–50 mA. M1 could be a regular voltmeter, but it would be cheaper to re-calibrate a used one.

Binding posts are used to connect the diode under test to the circuit, but to save time, I made two adapters from banana jacks and alligator clips. These plug into the binding posts, and diodes can be attached to the alligator clips. To test an in-circuit diode, one end should be disconnected and both ends connected via clip leads. Keep it safe: Apply no power to the circuit while the diode's under test!

The connections to the DVM are through a pin jack (for the positive lead) and a binding post (for the negative lead). This is to mate with my DVM, which has an alligator clip for the negative lead. I can easily plug in the positive probe and clip the ground lead to the binding posts.

Testing procedures

Now that we have built our new piece of test equipment, let's put it to the test! Select an unknown diode and connect it to the diode binding posts. The polarity is unimportant at this time. Turn switch S2 to "GO/NO GO". Turn S1 to "ON". One of four LED combinations may occur:

1. The green LED will light. This means that the zener is OK and connected

1. Turn power on.
2. Switch to "Go/No Go".
3. Connect diode.
4. Re-orient diode if LED shows it reversed.
5. Turn "Voltage Adjust" pot to extreme left.
6. Switch to "Zener".
7. Slowly bring voltage up until it no longer rises.
8. Connect digital voltmeter to measure voltage more accurately.

Table 2. ZenerMeter directions.

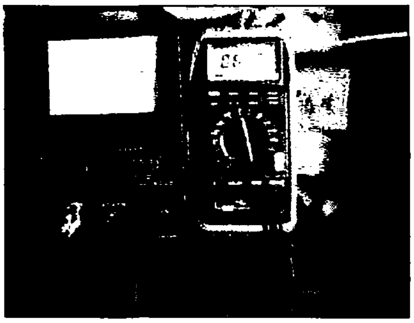


Photo A. The ZenerMeter tests a zener diode (6.10 volts), with a DVM hooked up alongside as a more accurate readout of the zener's voltage.

correctly (to run the zener voltage test). If you are testing a regular diode or LED and get a green indicator LED, this means that the test diode is good but connected backwards. An LED under test will light if it is good.

2. The red LED will light. This means the zener is OK but connected backwards. If it is a regular diode, it is good and correctly connected. Again, a good LED under test will light.

3. Both LEDs light. The diode under test is shorted or very leaky. Test it for voltage regulation. You may have to reverse the leads at the binding posts. Many of the components we get as bargains are often "floor sweepings" that fail industrial testing but can still be used in many projects.

4. Neither LED lights. The diode is open, or has zener voltage higher than about 15 volts. Run the zener test anyway—you might get lucky!

Zener test

1. Turn R1 to the extreme counterclockwise position.

2. Turn S2 to "Zener".

3. While watching the meter, slowly bring up the voltage by turning R1 clockwise.

4. At some point, the voltage will stop going up as you continue to raise it with R1.

5. This voltage, as measured by the meter, is the zener voltage. If you need to know the precise voltage, connect a DVM to the jacks. Do not continue to raise the voltage much beyond the point at which it stabilizes.

If the voltage never rises above zero, the diode is shorted. Reverse its polarity and retest it. If the voltage never shows a point where it stabilizes, then the diode is open or has a higher-than-30-volt zener point. Reverse polarity and retest—you have nothing to lose.

Non-zener diodes can also be used as a zener substitution or in series with others to create a very precise voltage reference. Silicon diodes "zener" at about 0.7 volts, germanium diodes at about 0.3 volts, and LEDs at about two volts.

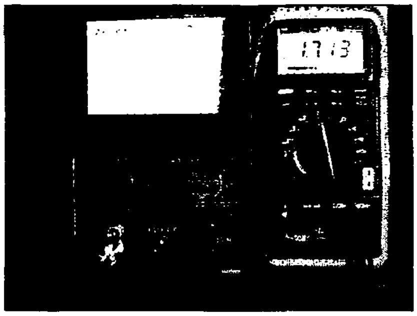


Photo B. An LED in the zener test mode shows the voltage at which it "zeners" (1.713 volts).

Congratulations! You have just constructed a useful piece of test equipment to help you build and repair your gear. Make a copy of the schematic and paste it inside the unit. You may wish to copy the set of directions on the back to help you remember how to use it. Have fun!

Parts List

BP1, BP2, BP3	Banana-plug-type binding posts
C1	1000 µF 50 V electrolytic capacitor
D1	1N4007
D2, D3	Red LED
D4	Green LED
J1	Pin jack, chassis-mounted
M1	Voltmeter, 30-volt range or recalibrated surplus meter (see text)
R1	10 kΩ pot, linear
R2, R3, R4, R5	1 k 1/2 W resistor
S1	SPST switch
S2	DPDT switch
T1	Transformer, 110 V primary, 24 VCT secondary

Miscellaneous: Case, line cord, 2 alligator clips, 2 banana plugs

Table 3. Parts list.

Cheap and Portable Loop

...for 20 through 40 meters.

Jay M. Jeffery WV8R
26150 Village Lane, Apt. 209
Beachwood OH 44122

This is the ultimate minimal-cost and minimal-construction loop antenna. It is portable and can be quickly disassembled and tossed in the trunk or on the rear seat of a car—yet it is large enough to give a good account of itself when you are operating QRP (although you would need a sturdier variable capacitor if you wished to exceed 10 or 15 watts). Finding components for it in the basement and building it took less than two hours.

The circuit design

The circuit design is quite simple. There is a main loop in series with a trimmer capacitor (20–180 pF) and a feeder loop about one-fifth the size of the main loop. **Fig. 1** shows the circuit. Ocean State Electronics has such a capacitor (#TC-463). Their phone number is (800) 866-6626.

Constructing the antenna

The main loop is made of solid insulated #12 house wire. #10 is worth a try, but I was using what I could find in the basement. This loop is 144 inches long. The feeder loop is made of the same wire and is 28 inches long. The wire of the loops is mounted by means of pieces cut from a terminal block (Radio Shack #274-678). The three pieces needed are cut so that they each have two connector terminals and a hole that accepts a small wood screw. These sections are then fastened to the support mast.

The mast is a three-quarters-inch by one-half-inch hardwood trim strip four feet, four inches long. The base is made from one-inch-thick pine board built up in the center by means of a smaller piece of the same board. A rectangular hole cut in the center of the built-up base should be a tight fit for the mast. This way the parts can be easily pulled apart for transporting. See **Photos A** and **C**.

The capacitor is soldered to two short pieces of #12 bare wire so that it can be inserted in the terminal block mounted at the top of the mast. The heavy wire provides the rigidity needed when the capacitor is being tuned. See **Photo B**.

The second block is mounted at the bottom of the mast to hold the bottoms of both loops (**Photo C**).

The main loop is divided into two parts. About half an inch of insulation is removed from the ends so that they can be inserted in and held by the blocks. The top block connects the loop halves in series with the capacitor. See **Photo B**.

The bottom block connects the two halves together. When the halves are

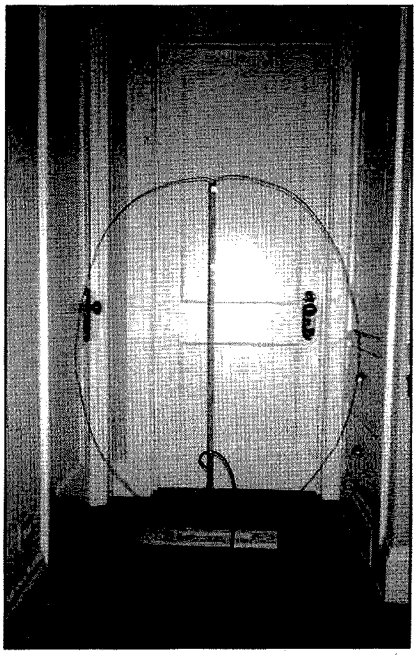


Photo A. General appearance of the portable loop.

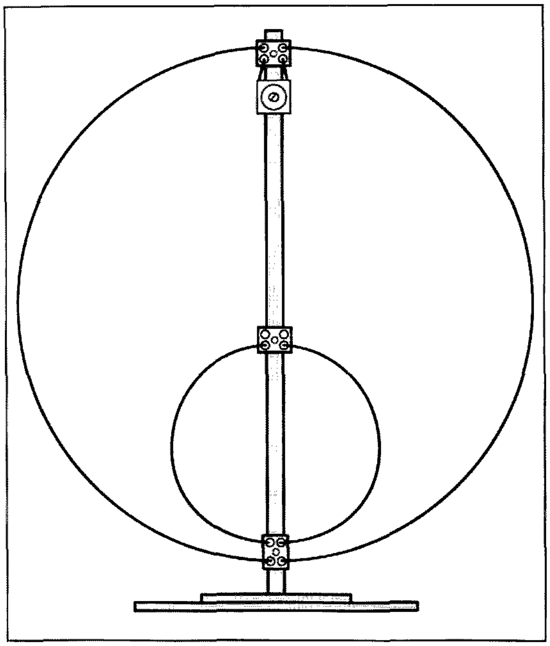


Fig. 1. The loop circuit.

attached, the wires are bent into an oval shape. The loop can keep its shape without a crossbar when used inside a building. Using it outside in the wind requires more rigidity and a clamp to hold it to something like a picnic table. If you toss it in the car for a trip, you may have to reshape it a little before use.

A third terminal block is positioned high enough above the bottom of the main loop to hold the top of the feeder loop. This loop is also divided into two halves for mounting. This terminal block also connects the coax to the feeder loop. The coax is secured to the mast by means of a piece of Plexiglas™ and a wood screw. The coax should come out from the mast as close to a right angle to the plane of the loop as possible. See **Photo C**.

The bottom of the feeder loop connects through the top connector of the bottom terminal block section. Bring this loop as close to the bottom of the main loop as possible on either side of the block. I taped the loops together for close proximity and rigidity (**Photo C**).

Tuning and operating the loop antenna

The loop can be tuned to a specific frequency by connecting it to a receiver which is set for the frequency to be used. Using an alignment tool (such as the Antique Radio Supply #ST-8609 or just a thin dowel sharpened into a screwdriver), tune the trimmer capacitor until you hear background noise or a signal. Maximize the noise or signal. Final tuning can be done by transmitting at low power when the frequency is clear and adjusting the trimmer until a field strength meter is maximized. A quicker and cleaner way is to use an antenna analyzer to get the best SWR.

Placing an antenna tuner and an SWR meter in the line will help to protect your rig and give a greater range of frequencies without retuning the antenna itself. Avoid touching the antenna during transmissions. Touching any open metal on the antenna could cause injury even with low power.

The loop is designed to be used in the vertical position. This allows the loop to be used when placed near the ground or something that acts like a ground plane. This position has the

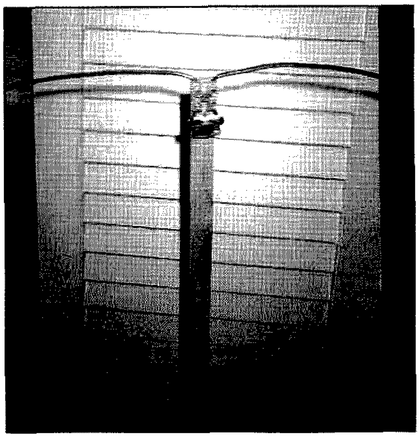


***Photo B.** Top connections of the portable loop.*

added advantages of providing a null perpendicular to the center of the plane of the loop, as well as gain in the plane of the loop.

Important considerations

The antenna is designed for indoor use, but with a crossbar, a cover on the capacitor, and a clamp to hold it down to a picnic table or any nonmetallic flat surface it could very well be used outside. If you live in a building that contains a lot of metal in its construction (e.g., steel and concrete, aluminum siding, etc.), then you will need to get the antenna outside of the building. Also, it should not be placed near a mass of metal.

It works fine

If tuned properly, the antenna works quite well using a couple of watts. I've even made some local contacts with it using a NorCal 40-9er running 150 milliwatts. I got good reports, but then again, they were within 50 miles—with as much as five watts you could "work the world!"

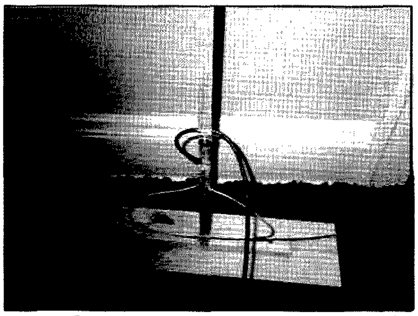


***Photo C.** Base and base connections of the portable loop.*

Number 46 on your Feedback card

Automatic Morse Station IDer from Comm Spec

Perfect for fox hunting and repeaters.

Breckinridge S. Smith K4CHE
104 Brookfield Drive
Dover DE 19901

When you read the ham magazines every ad seems to sport a board with a microprocessor installed. It's hard to evaluate all the products but when I saw the ad for this IDer board by Communications Specialists I immediately ordered one to test as a foxbox timer/IDer and to install on our local UHF repeater, which was being rebuilt. Good-bye, diode matrix—hello, microprocessors!

The ID-8 is made by Communications Specialists, Inc. (most technicians refer to the company as "Comm Spec") and Comm Spec has been making specialized boards for over 30 years. Their PL boards are well known in the two-way industry and their technical help over the phone is great.

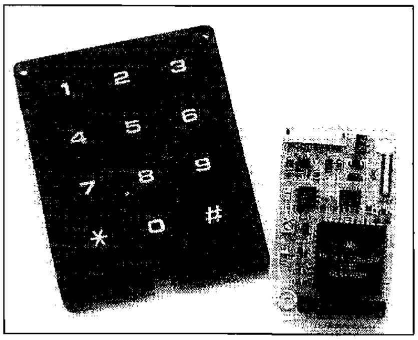


Photo A. Communications Specialists, Inc.'s Model ID-8 automatic Morse station identifier.

The package containing the ID-8 arrived, and my wife watched carefully as I unpacked two small pieces.

"What is that?" she asked.

"Nothing, honey. Just a microprocessor board."

"Oh, another gadget—don't you have enough?"

(Take a minute here to laugh.)

Back to business

I found that the main board, with its MC68HC705C8CFN CMOS processor, and the plug-in keyboard (which mates with the main board for programming your specialized information, such as timing intervals, callsign identification, or messages) were in the box. All of your programmed information is permanently stored in an EEPROM and can be altered at will. Power can be removed from the board and the information will remain intact. The board is small, measuring 1.85 by 1.12 inches. The keypad looks like a Touch-Tone™ pad, but actually is a 12-button keyboard that takes lines low, via the programming port (J2 on the board). The keypad plugs into the top of the board, piggyback style, and expands the area of the board by an inch and a half. Comm Spec cautions you on the first page of the instructions to provide room in your installation to allow plugging in the keyboard.

If you find that your installation area is cramped, you can always power up the board temporarily, program your info, and then remove the keyboard prior to the installation.

While I examined and tested the board, I realized that there wouldn't be any tedious sessions of soldering wires or connectors to the board; the wires are color-coded and are hard-wired to a connector for mating with the board. There is no microscopic soldering of jumpers, or removal of jumpers, to set up or program the board. This can only enhance reliability of your installation

(and keep you out of surface-mount therapy). The board has its own voltage regulation, and can accept 6.0 to 20.0 VDC with a current drain of only 6 mA. During my testing I just used a nine-volt battery, and the battery seemed to last forever. You can immediately test the board to get a feel for the operation, as it is factory-programmed with a call and timing values—just hook up power and listen to the audio output.

The whole pizza

I was initially concerned about the specific number of characters that I could store in the IDer slots, as I had plans for longer messages, but Comm Spec has provided the whole pizza—not just a slice. You can program a message of up to 216 Morse characters in a single slot or message. You can have up to eight separate IDers or messages, with 69 characters in the first message, and 21 in each of the other messages, or you can gang messages together. The messages are selected by three wires on the board that you ground to activate. Be sure to consult the message table on which wires to select your message; for example, to select message #2, you ground message wire #3, which is a little confusing. A really nice feature of the board is that you don't have to leave any unused message select lines "high" or "low" and there are no external resistors. You just simply leave a wire unconnected, if it is not used. If you just leave the "message select" wires alone and don't ground any of the lines, then message #1 is activated.

Neat twist

When you use this board to key a foxbox you can have an exterior switch on the box, so that when the first hunter finds the box, he flips the switch and a different message, such as "The fox is found" will now be sent at the same interval. "The fox is found" message concept was first used on the East Coast by Dwayne WD8OYG, of LDG Electronics. It puts a different twist on the hunt.

The Morse code table in the ID-8's instructions is used for your programming. It uses two digits for each alphanumeric character and includes everything you could want, including fraction bar, space, period, and all the CW stuff such as AR, BK, BT, and SK. If you don't like code, throw some of them in anyway—just to confuse everyone. The CW audio tone frequency can be programmed from 100 to 3000 cycles and the speed is variable from 1 to 99 wpm; 70 wpm seems like a good speed for repeater IDers. If you want to have your foxbox key up with a steady carrier *without* sending a lot of CW, then just program in lots of "spaces" to provide the necessary transmit "on" time and then include a short ID. During the programming process, it's best to be able to monitor the audio output of the board, as the ID-8 will beep each time you enter a programming mode, and will generate another beep when you successfully complete a programming sequence. You can test-play your messages without disconnecting the keyboard; just leave it in place and type in one of the eight "play messages" commands. One of my favorite audio monitoring tools that I use in the shop is a Radio Shack™ amplifier (#277-1008C), which has its own nine-volt battery, audio amp, and speaker, all built into a small box.

As you punch the keys, if you screw up, the ID-8 sends out a triple beep to advise you of your lapse in mental dexterity. Comm Spec obviously has a ham on their staff, as the Morse code table is perfect and the programming is easy. If you get messed up during the programming and want to declare programming bankruptcy, then just key in the "reinitialize" code, and the board will return to its factory default values so you can start over.

Good timing

The timing sequences for your message or ID can be programmed via the keyboard; you can send a message at a programmed interval when the trigger input wire is active. The ID-8 won't send the message until the interval has expired and the trigger line is active. If you have built repeaters, you know sometimes you spend a lot of time hunting all over your equipment for signals of the right polarity to activate

your add-on boards. The neat thing about the ID-8 board is that during programming you can program the board to trigger on a "low" or a "high." There is also an inhibit line that can be programmed to inhibit transmission of the message on either a "low" or a "high" signal.

The timing sequence was interesting to play with. If your message is very long, for example a minute and 30 seconds, then the full message is played and the timing interval begins. The interval timer can be set from zero to 99 minutes and to the nearest one-minute increment. If you don't like even-minute timing, then put in a delay in the hold-off timer for the number of seconds desired. During your foxbox operations just keep the trigger input keyed and the foxbox will continuously transmit at the programmed interval.

The push-to-talk output of the board is an open-collector transistor with a specification keying rating of 80 volts and 300 mA. This should be more than adequate for keying needs. Comm Spec gives the usual caution about keying relays with this line, so be sure to install a protection diode across any relay coil that is keyed by the board.

I mentioned earlier that there has to be a ham on the staff at Comm Spec, as they've thought of everything. The output of the board can be programmed to be either audio or carrier wave mode. In audio mode the output is audio but in carrier wave mode the output is via the PTT Output and the Morse code keys this line, which can be used to key your CW transmitter with the same PTT keying limits of 80 volts and 300 mA. During my testing, I also found that when the PTT output is used for CW keying, the tone is still available for modulation of the carrier. Thus, you can send true modulated CW for a unique sound. The CW output on the PTT line is perfect for beacons on VHF or if you want an interesting foxhunt, try keying the foxbox carrier on and off with the CW message. Put an important clue in the message—make those hunters get off their duffs and learn some code!

For your repeater installations there are a couple of features that can be programmed. A courtesy tone, which consists of a 50-millisecond beep, is generated at the input of a signal transmission; the courtesy beep can transmit as soon as the "trigger" input is released from an active condition and is inhibited automatically during Morse code transmission. Another good timing feature for repeaters is a "front porch delay" which will delay the sending of the message for up to 10 seconds, and can be programmed via 100 millisecond increments via the keypad. There is plenty of audio available on the board, up to four volts, and it's adjustable by a pot on the board. According to Comm Spec's note on the instruction sheet, the pot does not have any stops and can be rotated 360 degrees.

I really liked the board. Overall, I'd call it an excellent product from Comm Spec—a rugged little board that has bounced around my workbench for a month. I deliberately tried to abuse it, and it survived. It's not sensitive to RF and is easy to install. A lot of features are crammed into a small space; it has its own programming device and it's easy to change programming in the field. It's perfect for a basic repeater IDer, propagation beacon, or foxbox. The price is $69.95. You can order it from Communications Specialists, Inc., by telephoning (800) 854-0547; FAXing (714) 974-3420; or by writing Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 928665-4296. Be sure to check out the Web site at [http://www.com-spec.com].

NEVER SAY DIE

Continued from page 38

magnetized (wetter) water, prayer, UVs, and so on. The mind tends to boggle (with apologies to my old car rallying friend Alan Turoff, who invented not the word, but the game Boggle™—I see, according to the TV program *King of the Hill*, that they're having Boggle tournaments these days). If nothing else, what a great science fair project it would make for kids to grow seeds using these systems for increasing growth, both alone and in combinations. With Sonic Bloom providing about seven times ordinary growth, by the time a few other approaches are used we could be seeing 10 and even 20 times standard growth!

Yes, I guess I'll have to start a newsletter or journal for the super-growth gardening fans. Should I call it *The Green Thumb?*

Not only can we start producing fruit and vegetables which will be infinitely healthier to eat, but these technologies should also go a long way towards feeding the world's hungry.

Dowsing

Okay, what do you think about dowsing? Do you really believe that people can find water underground dependably? Like almost anything else, your answer will probably be determined by how knowledgeable or ignorant you are on the subject. It is easy to hold strong opinions on things of which you are ignorant.

Some months ago I reviewed *Vibrations* by Owen Lehto. This is the most practical how-to book I've found on dowsing. But Owen doesn't waste a lot of time trying to convince unbelievers. Christopher Bird, however, does in his monumental *The Divining Hand*. Once you've read this book I guarantee you will no longer be a skeptic. You won't even be on the fence. Bird goes over the history of divining, which goes back at least a thousand years. Then he covers the scientific research done in the field. And there's been plenty. He's done his usual massive amount of research.

For instance, a scientist set up an experiment by driving two iron posts in the ground several feet apart. He fed a small voltage to them to see if dowsers could detect it. He found that 80% of the people he tested could invariably detect a 20 mA current. A few could detect currents of 1 mA, and one chap was unfailingly able to detect 1 μA of current. This chap was also able to direction-find any radio station while blindfolded. They gave him the frequency and his dowsing rod would point to it.

There are water well drilling companies who use dowsing to find wells and charge

nothing if they fail to provide water at a flow rate they guarantee. They've never failed.

Experienced dowsers can find water veins, tell you how far down they are and the flow in gallons per minute to expect. They can even do this working with a map. They can reliably find lost objects and people. They can dowse for metals, oil, coal and natural gas. With oil they can tell how far down the top of it is, the size of the deposit, and its depth.

Dowsers can diagnose illnesses and locate the site of the trouble. They've found that many, if not most cases of arthritis and cancer involve people sleeping over several veins of water. When their beds are moved to a place where there are no underground water veins they miraculously recover. Underground water veins can also make animals sick, and even trees!

Well, if something coming from the water is making people sick, then it should be possible to detect it scientifically, right? And they can, using a gamma ray detector! In some way the moving water projects a narrow beam upward which, over time, can generate many different illnesses. But you don't need a gamma ray detector when a simple pendulum will do the job.

An experienced radiesthesiaist (medical dowser) can use a pendulum to find the cause of an illness and to find the best medicine to cure it. They can even do this from afar! And it works on animals as well as people.

By shielding a dowser's body they've been able to locate the areas of the body which do the detecting, with one being located in the head by the pineal gland and the other by the adrenal glands.

If you'd like to become an expert on the subject, get Chris's book. It's $30 and is available from several sources. It's a big, glossy, well illustrated book. It's listed in the American Society of Dowsers book catalog, (800) 711-9497; Radio Bookstore, #5963, (800) 243-1438; Acres USA, #6194, (800) 355-5313.

It's easy to learn to dowse, and almost anyone can do it. But it takes experience to get to be good at it and to learn the right questions to ask. You can do it with bent rods, a pendulum, a piece of plastic (à la the Hieronymus machine), or even just with your hands.

I suppose I should have put this into the April issue as a way to deal with readers so grounded in science that they get upset when something unexplainable is claimed to work. Well, I'll put my science background up against just about anyone's, but it hasn't stopped me from reading and learning new (or old) and exciting things.

Fair Enough?

If all those weird ways of stimulating plant growth for a science fair project aren't enough, I've got one more for you. This has to do with voodoo—no, it's what's called "paramagnetism." It seems that if you hang things by a string and put a magnet near them, those which are paramagnetic will be attracted a little bit. Stuff that's weakly repelled is called diamagnetic. Like wood and water. Most organic stuff is diamagnetic and the most paramagnetic are volcanic rock and ash. Like basalt, which is almost off the chart.

It's difficult to measure paramagnetism with a string and a magnet, so the "experts" in the field use a pendulum. Well, why not—once you get the hang of it, a pendulum will dowse for just about anything you ask it to.

But you don't have to buy into any of this to do the experiment and see for yourself. Some high school kids have won local and state science fair contests with this one.

Since basalt has the most power, if you can find or make a basalt rock about three inches in diameter and 12 inches long, you're in business. Granite will do. The idea is to emulate in miniature the round towers of Ireland. About 65 of these still remain, and the fields around them are in much demand by local farmers, who want to fatten their cows on the luxurious grass that grows there.

For the experiment use two plastic buckets or dishes filled with potting soil from the same bag. Plant radish seeds about half an inch deep around the pots, three or four seeds per hole. Water both pots the same and keep both in the sunlight, but in one place the stone in the middle. The shape of the rock isn't critical.

After eight days in a growing temperature of 70–80°F., pull the plants up and weigh the roots' "held in place" soil. You'll see that the plants to the east are the smallest and lightest. Those to the north and south will be middle-sized, and those to the west of the rock will be the largest and heaviest. The plants in the control pot should all be the same.

Now why should a rock in the pot have such a startling effect on plant growth?

The next step, naturally, is to start using this phenomenon to our advantage.

If you're interested in reading more about this you can read *Paramagnetism* by Phil Callahan (#6158 from Acres USA, $15) and *Enlivened Rock Powders* by Harvey Lisle (#6103, Acres USA, $15).

I've been interested in the using of rock powders to both stimulate plant growth and as a way of providing the minerals which are missing from our commercially grown produce. In the Hamaker-Weaver book, *The Survival of Civilization* (Acres USA, #6221, $12), Weaver mentions his eating a quarter to a half teaspoon of rock dust every day to supply the missing minerals. Talk about nitty-gritty! But it solved his chronic constipation problem.

There are a bunch of enlivened rock powders on the market that farmers feed to their livestock. It makes the animals more alert, have glossier coats and be generally much healthier, so they should help people too. Hmm, have you any rock powder recipes for me? Yum.

Supersonic Lemons

By treating the roots of a lemon tree with supersonic sound, an experimenter has been growing two-pound lemons. He found that the tree's branches were producing four flowers instead of one, so he pinched off three of the flowers, allowing all of the growth to go into the fourth. The lemons grow so large that they have to be supported so they won't fall off the tree before they are ripe.

No, I don't have any details on the frequencies used, so get busy and start experimenting. That should make a great project using any fruit or vegetable bush or tree.

Rocking

David Merrill, a Suffolk, Virginia, high school student, won top honors at the regional and state science fairs with his mice and music experiment. After establishing a baseline of 10 minutes for mice to navigate a maze, David started playing music 10 hours a day to two groups, keeping the third without music as a control. He then put the mice through the maze three times a week for three weeks. The control group was able to cut five minutes off their time. The classical music group cut eight and a half minutes off their time, and the rock music group took 20 minutes longer to navigate the maze.

David had to cut his experiment short because all the rock music group killed each other. None of the other groups did that. (Source: *Washington Times*.)

Which brings the question to my mind of how much of the kids killing kids we're seeing these days may be caused by them listening to rock music? Guns in schools, falling SATs, a lack of motivation and perseverance could all be connected to some extent to the hard rock craze and addiction.

So, how much classical music did you play to your children while they were in

Continued on page 84

Number 50 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

The Internet: Where's it going?(And what does it mean to ham radio?)

A little historical perspective: The Battle of New Orleans (1814) was the only major land battle won by the United States during the War of 1812—but it was a hollow victory, because it took place two weeks after the war ended. The message announcing the end of the war did not arrive in time. Why? Because communication in 1814 was very, very slow. Messages went by horseback courier or sailing ship. General Andrew Jackson enjoyed no better communications between Washington and New Orleans than Julius Caesar had between Rome and Gaul. Indeed, Caesar may have had better communications because of the road system built by the Romans.

The modern telecommunications revolution began less than a generation after the Battle of New Orleans, when Samuel F.B. Morse (of code fame) invented the telegraph. By the Civil War much of the country was humming with telegraph wires, and communications time between distant cities was reduced to a few minutes. Stonewall Jackson had communications technology that Andrew Jackson could not even comprehend. It took another generation to invent the telephone, which allowed voice communications, still another to invent radio, and yet another to make widespread use of radio communications. Ham radio operators helped a lot in the development of early radio.

The accelerating rate of progress in communications is seen by certain historical events. The first transatlantic telegraph cable was completed between 1855 and 1857, and could transmit no faster than about 50 or 60 words per minute. A transatlantic cable required a huge voltage at each end to be able to "tickle" a telegraph responder on the other end. I've read that 1,800 volts DC were used to overcome 2,000 miles of I-R losses in the copper wires!

It wasn't until 1955, a century later, that the first transatlantic telephone cable was laid. Transatlantic telephone service actually began in the 1930s using high-frequency shortwave radio channels. Capacity was limited, and waits of several days to get a free line were not uncommon. Ionospheric disturbances and magnetic storms, caused by solar activity, often eliminated the telephone channel for hours to days at a time.

Only nine years after the first transatlantic telephone cable went into service the first global communications satellite (AT&T's *Telstar I*) was launched. In the decades since *Telstar I* so many satellites (communications and otherwise) have been launched that colliding with "space junk" is a distinct hazard. A plan is approved to launch hundreds of new communications satellites in low Earth orbit in the next few years. Progress in telecommunications today proceeds at such a whirlwind pace that it is difficult to keep pace with advances.

Concurrent with, and because of, the telecommunications revolution, is the development of now commonly-available services such as cable TV and the Internet. Where Andrew Jackson and Julius Caesar had to wait weeks for messages to arrive, we today have instantaneous messaging, graphics, video and audio available at our fingertips through the telephone companies, Internet service providers (ISPs) and cable TV companies.

The baseline capability expected by the public has increased dramatically in only the past two decades. Where most users were limited to a single channel analog voice system (telephone), we now have the ability to conduct online sessions with participants in all states and on all continents, simultaneously.

The Internet

The Internet started out a couple decades ago or so as a means for scientists and engineers connected with the Defense Advanced Research Projects Agency (DARPA). The World Wide Web (WWW) was added much later, but buzzes with activity. The amount of information that you can obtain from the WWW is simply stupendous.

Some people don't want to use the WWW because, they say, pornographers and child-abusing perverts hang out there. They sure do, but so what? First, although you might occasionally click into a porn/pervert site, and you may occasionally get objectionable E-mail pointing to such sites, you won't normally encounter them unless you want to. It's kind of like "adult" bookstores. I find them objectionable, so I take note of their blacked-out windows and pass them by ... I don't go into stores I object to ... it's that simple. Nor do I go to WWW sites that look suspicious.

As to the child abusers and perverts on the WWW, it's almost impossible to get involved with one of those unless you want to. Although kids get suckered in, adults rarely do ... and neither will the kids if they are well trained and counseled. Besides, if you read the local paper in almost every town, there are perverts and abusers everywhere.

Don't let the scary stories get to you. If you have a computer and a modem, then find an Internet service provider (ISP) that suits you and jump in. You can contact me at [carrjj@aol.com].

Where it's going

We're witnessing a coalescence of the three telecommunications services used by the public: telephone, cable TV, and Internet. The telephone companies and cable TV companies are rapidly either becoming ISPs themselves, or partnering with existing ISPs to offer bundled service. Canada and the United Kingdom are ahead of the US in this respect. The UK users might be driven to flat-fee cable TV and Internet bundled services because they use metered telephones (a long WWW surfing session can cost big bucks).

The key to combining services is to provide a broadband connection. The telephone companies can't do that easily in some areas because of the "last mile" problem; i.e., they use twisted pair copper wires for the connection to your house. Don't count them out, however, because they have some really righteous technical capability. One study found, however, that telephone companies don't compete well with non-phone companies, and attributes it to their being monopolies for so long.

Cable TV companies already have 550-MHz to 800-MHz broadband service to homes. These can be used for high-speed Internet access if a cable modem is supplied. Although presently expensive, they are available in some areas.

The technical problem faced by the cable guys is that their present plants are one-way only. Converting to two-way plants, which is needed for Internet, is costly. It can be overcome, however, if the market is there in your area.

As telephone companies and cable TV providers begin to enter the Internet business, especially since they are able to provide broadband capability,

stresses and strains on the technical infrastructure of the net will increase. The Internet is already seriously constrained by its architecture, current bandwidth and growth rate. "The Internet is growing exponentially, but its instability is growing at an even more unnerving clip" said one commentator. If the net is unstable, then its utility to all users is compromised.

One problem is that a major source of the instability is the inability of routers to "... announce and withdraw traffic routes accurately and frugally ..." One source of the problem is that routers are overburdened with those routing updates, and those which see the greatest number of updates are the most likely to drop data packets. The effect of dropped packets on TCP/IP is "... a sign of congestion, prompting a dramatic slowdown in the flow of information across the network." Router instability also has encouraged widespread implementation of software aimed at route "dampening," a process that lets Internet service providers turn a deaf ear to routers that repeatedly issue updates. Users behind such overactive routers risk losing their connections.

Update levels across the core Internet are on the order of three to six million per day, while experts claim that tens or hundreds of thousands is more reasonable. One problem is that "... 99 percent of these update messages indicate that a route is unavailable, even if the router has yet to announce that the route was ever available." This fact indicates that the network is "looping," i.e., sending out the same message over and over throughout the day, with its own update message traffic being the major factor that makes the routes unavailable.

Non-random network announcements

Network announcements, e.g., route availability, are expected to occur randomly throughout each minute of the day. Random message generation tends to lessen the load on the system. However, it is noted that such messages are generated periodically, not randomly, on a cycle of about 30 seconds. This class of problem was traced to the Routing Information Protocol (RIP) several years ago when it caused the Internet to collapse.

Some authorities are claiming that problems in the Cisco Systems routers are the cause of the problem. There is a conscious design trade-off in Cisco routers between speed and memory that results in "... a small number of extraneous [route] withdrawals ..." But Craig Labovitz (Merit Network Researcher) states that the source of the 30-second synchronization problem is not known. He asserts that only one percent of the problems can be attributed to any one vendor product. Labovitz does not know what causes the 30-second phenomenon, but suggests it is "... a systemic, widespread, inherent problem that we might be able to fix in the Internet infrastructure." The problem is being worked on by routing vendors, ISPs as a consortium, and the Internet Engineering Task Force (IETF) through the National Science Foundation's Routing Arbiter Project.

[Note: Chaos researchers might be interested in examining this problem. Synchronization is a well-recognized phenomenon in chaotic systems. In addition, the work of Stuart Kaufmann at the Santa Fe Institute indicates that chaos is possible in any system that has more than three nodes and two connections per node, which qualification the Internet probably meets.]

Weak link phenomenon

Internet traffic sends data packets by different available routes. Imperfections such as timing fluctuations ("jitter") and latency (pauses between request and delivery of packets) are a real problem for large applications such as graphics. Because the packets may pass through a number of routers and ISPs, the weakest link in this chain between originator and receiver of the item sets the perceived quality of the entire network. As a result, varying capabilities between ISPs make it possible to seriously degrade overall quality. A large amount of upgrading might need to happen as the net expands.

Bandwidth limitations

Multimedia, voice/telephone, video, net FAX, and a host of other applications being sent over the Internet are increasing the demands for bandwidth at a tremendous rate. High-bandwidth users are replacing multiple T1 lines (1.544 mbps) with T3 lines (44.763 mbps) or OC3 fiber optic (155.52 mbps) lines. A typical ISP uses four to six T1 lines, and many are rapidly moving to eight to 10 T1 lines. Part of the pressure moving the ISPs to T3 lines is the difficulty in obtaining new T1 connections from the bandwidth providers.

One source claims that the Next Generation ISP will require scalable bandwidth from three to 155 mbps. Other sources note that the largest Network Access Point (MAE East) reached 240 mbps in 1996, and that MFS Data Services (NAP in San Jose, CA) expected to hit 500 to 600 mbps in 1997. MAE East reports that it "... will be cranking to the tune of 7.2 gbps by the time (2000) rolls around."

Telephone companies and cable TV companies stand to gain ground because of the higher bandwidth now being required by Internet customers. They already have the bandwidth infrastructure needed for new applications.

[Note: An implication of upgrading the Internet is that it may no longer be a "free" resource. It is expected that some sort of billing will be instituted

Number 52 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. Part 2 of that series was presented last month; part 3 follows.

Lightning protection—what your mother never told you, Part 3!

We continue this ongoing series on lightning protection with some tips on ham radio tower installations. Be sure to read the two previous parts in this series in the January and February issues of *73* too, as they contain information essential to achieving a complete understanding of the material. You can read the entire text immediately, by calling up the Special Bulletin "Protection to Keep You Communicating" at PolyPhaser's home page on the World Wide Web at: [http://www.polyphaser.com/]. Past "Ham To Ham" columns can be accessed at *73's* "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Now on to this month's topic. The first rule ... don't use a nonconductive structure for an antenna support! Conductive towers or metal poles should be used for mounting antennas high into the air. If the tower or pole has sliding contacts (telescoping, crank-up or push-up), the joints should be jumpered using short sections of copper strap attached with appropriate clamps such as PolyPhaser's TK clamps (see **Fig. 1**). Normally, self-supported and guyed towers do not require jumpers across their joints. Joint compound should also be used so that rain water will not drip onto the galvanized surface of the support structure.

Guyed towers are better from a lightning protection perspective, if the guy anchors are grounded properly. Because the anchors are located away from the tower base, some of the strike energy will traverse the guy wires to ground, even though these guy wires may have relatively high inductance. This is OK, because the more the strike energy is divided, the less energy the equipment indoors may see, and that, after all, is our objective.

Dissimilar metals

Copper should never touch galvanized metal without proper joint protection. Water shedding from copper contains ions that will wash away the galvanized (zinc) tower covering. Stainless steel can be used as a buffer (transition) material (see **Fig. 2**); however, stainless steel is not a particularly good electrical conductor. If stainless steel is used as a buffer between copper and galvanized metals, the surface area of the contact should be large and the stainless steel itself should be thin. Joint compound (available from a number of sources, including PolyPhaser) should be used to augment the connection, so that water will not be allowed to form a "bridge" between the dissimilar metals.

Magnetic energy

Lightning produces a very large magnetic field as would be expected with its typically 18,000 ampere pulse. This magnetic field will tend to inductively couple into all nearby conductive materials. There are two ways to minimize the amount of magnetic coupling:

1. Carefully shielding all sensitive equipment.
2. Placing some distance between the equipment and the likely strike location.

A galvanized steel sheet may also help (when used as a

---

in the future. The abortive foray of America Online™ into "unlimited" access may well be a portent for the future. "... Service providers cannot make adequate margins through flat-fee access and undifferentiated service."]

So what does it mean to us?

Like many other technologies, the Internet is a two-edged sword. There are benefits and problems. The bennies include being able to research technical and operating topics, and to make connections with others doing the same. Checking into any forums or Web sites dealing with amateur radio shows a plethora of really neat stuff out there. Also, we can promote amateur radio on the Web, distribute training materials, and generally use it for educational purposes. There is no reason why there can't be an on-line "Virtual Elmer" to mentor our newbies and future Novices.

On the down side, keep in mind why amateur radio exists: "to serve the public interest, convenience and necessity" (PICON principle). One of the ways we meet our PICON responsibilities is distributing message traffic. But who needs us when they can send E-mail? Also, in times of disaster amateur radio does brilliant work handling emergency traffic, especially of the "health and welfare" (H&W) variety. Although disaster authorities can rapidly fly in a satellite communications system (heck, they've got 'em small enough to fit into a suitcase), those systems and the authorities operating them are usually too busy to handle a lot of H&W traffic. Yet, it's the H&W traffic that means so much to people whose loved ones are in the disaster area.

Now, however, it is all too easy to set up impromptu H&W networks on the Internet. And the originating stations in the disaster area can use cellular telephones and laptop computers to do the work.

It's not all downside, however. There is no reason why the ham operator doing the H&W traffic can't also be on the Internet. It is really little more than one more way of getting the H&W traffic to its final destination. What we need to do is figure out how to best merge amateur radio and Internet services in times of disaster.

On the technical side, there might be a few problems. Cable TV lines already sometimes leak energy into the two-meter and six-meter ham bands. That can only be expected to increase unless the local utilities use fiber optic cables to distribute their services. There are also compression techniques now available that will permit high data rates in the HF spectrum, so we might see problems on the HF ham bands as well.

Connections ...

I can be reached via snail mail at the address above; or via Internet E-mail at [carrjj@aol.com]. My books can be bought through Amazon Books™ on the World Wide Web [http://www.amazon.com]. Be sure to type "Joseph J. Carr" (my full name) in the search panel if you don't want to get a lot of titles by other "J" or "Joseph" Carr authors. 73

magnetic shield) to attenuate the lightning's magnetic field pulse (usually by about 10 dB). This steel sheet should be at least 30 gauge (0.016 inch thick) and should be bonded to the system ground. The shield must also be broadside to the direction from which the pulse will emanate.

Distance can sometimes be effectively used to limit magnetic field coupling. The strength of any magnetic field diminishes at the rate of one over the distance squared. Since a moderately high tower is more likely to be struck than any other nearby structure, the placement of the tower with respect to your equipment room warrants significant consideration. Factors to consider include the magnetic energy that will likely radiate from the tower, and the benefit of distance in terms of the inductive loss provided by the length of the orthogonally-run coax; this added inductance of the coax line will help buffer any energy entering the equipment area. So this is one time when inductive loss is desirable. Do not, however, add loops to your coaxial line, since those loops may act as a transformer (depending upon their orientation), actually capturing more of the magnetic field energy and ultimately bringing it right into your ham shack!

Additionally, extra distance to the shack will provide more time for the tower ground system to absorb and dissipate the strike's energy, resulting in less energy heading toward your equipment. These factors indicate that a separation between the tower and the operating equipment of greater than 20 feet appears reasonable. For towers already located closer than this, it may be necessary to utilize some form of shielding (as mentioned previously) to minimize the magnetically induced energy.

Antenna location

A ground-mounted vertical antenna is similar to a ground-mounted tower. Both should have a substantial and low impedance connection to the station ground system. However, if the antenna or tower is mounted on a roof, the inductance inherent in the vertically-run conductors to the ground system can be significant. Voltages of several hundred thousand volts could be present. To reduce the inductance in these ground conductors, increase the surface area of the conductors (wider copper straps) as well as the number of conductors. For the roof-mounted antennas and towers, the multiple down-conductors can be spread over the roof and can then be brought down to ground in multiple locations. This will require the ground system to encircle the building (also called a perimeter ground) as shown in **Fig. 3**.

As an added benefit, this multiple down-conductor approach tends to reduce the mutual coupling between down-conductors and provides a low-impedance, unsaturated perimeter ground to absorb the conducted surge. The magnetic fields will be divided, and at least in theory, tend to cancel in the middle of the building (although in practice, the chances of these stray magnetic fields canceling on anything other than a perfect, geometrically-balanced and spaced down-conductor array, are slim to none).

That's all from Roger and Ron Block for this month. Be sure to check back next month for more thrilling advent— ... er, advice on helping to keep your ham station safe from the devastating effects of a lightning strike.

Telco two-fer

From Tom Siolek N3VUF: "I recently acquired a Radio Shack™ HTX-212 two-meter transceiver, which I'm using as a base station to check into my local two-meter nets as well as for packet radio. I've found it to be a fine radio for both applications. Yet, since it doesn't have a separate data port for direct connection to a TNC, the user must disconnect the microphone and replace it with a cable going to the station TNC for data work. Because the keypad and up/down scan buttons reside on the microphone, the user ends up losing the ability to change frequencies easily while running packet. For packet node hoppers, this can be an annoyance, since the only available frequency control is the detented main tuning knob, which has proven to be somewhat slow and cumbersome. The inefficiency is compounded if the computer monitor is located some distance away from the radio; it's not practical to run the microphone and its controls over to the remote position. There are commercially available in-line boxes that will switch between a microphone and TNC cable, but the ones I've seen so far won't accommodate the type of connector used on the HTX-212, plus they come with a rather high cost for a fairly simple function. The microphone jack in this radio is an RJ-45 type, the same that's used in Ethernet computer networks. There are other two-meter transceivers having similar setups today, so users of any of these may well benefit from the following low-cost solution that I've come up with.

"To allow me to use the microphone controls while running packet, I simply plug in a standard modular eight-conductor duplex adapter ... directly into the HTX-212. This device will automatically split a single

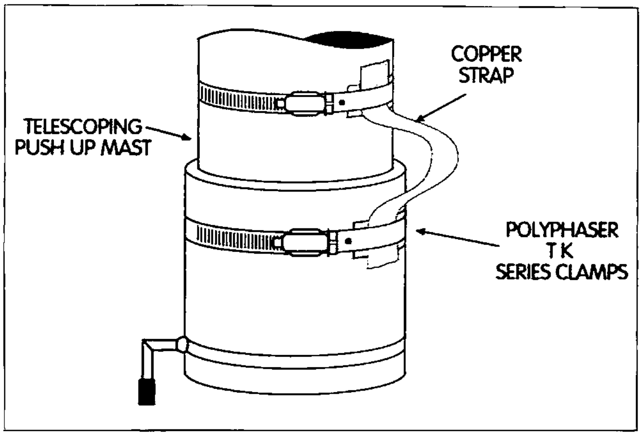


Fig. 1. The proper method of bonding two sections of a push-up or telescoping radio mast using PolyPhaser TK series clamps. It's important to remember that copper should never directly touch galvanized steel.

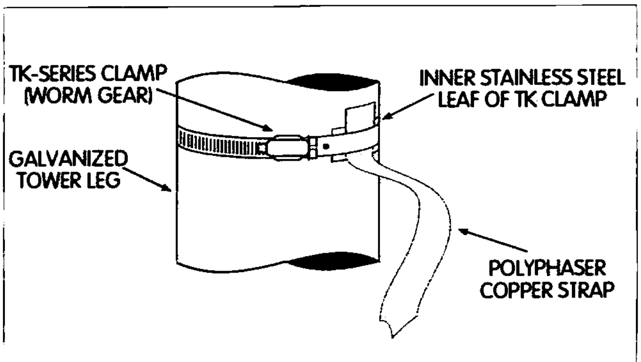


Fig. 2. Closer view of the TK clamp mechanics.

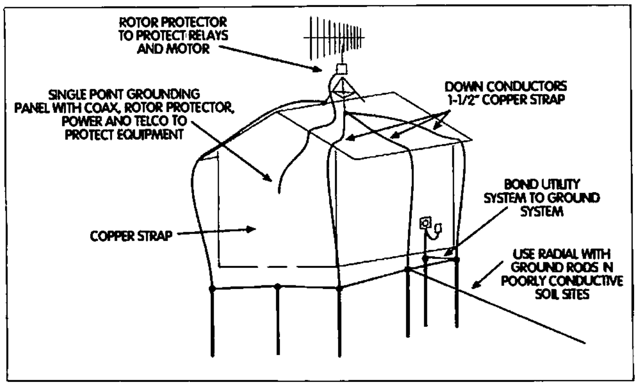


Fig. 3. A fairly typical roof-mounted antenna installation that should incorporate wide copper-strap down-conductors to a perimeter ground system. Note the tie-in with the existing utility ground connection.

modular RJ-45 jack into dual modular RJ-45 jacks ... just what I want. I then plug the microphone into one of the jacks, and the TNC into the other. This lets me operate packet, while not relinquishing the ability to directly input frequencies from the HTX-212's microphone-mounted keypad. The adapter I used is made by GC Electronics and carries their part number 30-9657. It cost me a mere $3.32 at my local electronics supply house, a lot less expensive than any other alternative I've seen. You might also be able to find these eight-conductor splitters in computer stores that stock Ethernet 10BaseT network cabling supplies or via mail-order from some of *73*'s advertisers.

"One caveat ... the setup works great on packet, but I've noticed that I end up with some 60 Hz hum superimposed on my voice signal when I operate on voice FM to transmit (with the TNC cable still plugged into the splitter). This appears to be due to inductive pickup from my station power supply, via the TNC's cable (since it clears up as soon as I disconnect the cable going to the TNC). It's not a huge problem for me, since I only use the RJ-45 splitter during digital operation, but I thought I'd mention it just in case you run into something similar. The inexpensive answer, of course, is to simply unplug the TNC's RJ-45 cable when you wish to operate on voice mode. Perhaps better isolation between the microphone and TNC circuitry might be the final answer, if you'd like to keep both items permanently connected, but that's the kernel of another, more involved project ... a home-brewed RJ-45-based switch box. For right now, the $3.32 solution works well enough."

Moderator's note: The 60 Hz hum that Tom noticed on his two-meter FM voice signal might also be due to a ground loop condition among the TNC, the two-meter transceiver, the computer, etc., or it could even be traced to a bit of RF feedback showing up as a hum-like extraneous modulation. Either case would require some "setup-specific" troubleshooting, but as Tom states, the easiest answer may be to just unplug the unneeded TNC cable when operating any other mode.

Clip-lead clutter reducer

From Peter Bergman NØBLX: "Often after building or repairing some electronic gadget, it's nice to know exactly how much current the item is drawing. Using the meter on the bench power supply itself (if your supply even has one) isn't always the full answer to the question. Power supply meters aren't usually all that accurate and you're generally stuck with just one 'overall' range, which may not be the right one for your needs. The meter on the power supply also records all of the current being supplied to all of the devices that may be connected to it at the time—again, perhaps not what you'd like to see specifically. The usual approach that most of us take at this point is to grab our collection of alligator-tipped test leads and start lashing our multimeter into the circuit. The result is clip-lead clutter, and often unintentional shorts or dangerously exposed wires scattered around our work area. The cure for this form of clip-lead clutter is amazingly simple. Take a look at **Fig. 4** and you'll see what I mean.

"All you need to do to avoid the clutter is to install one of those handy five-way binding posts on your power supply's front panel—the type of binding post that allows you to hook up several wires to it at the same time, safely. It's just a dummy binding post, so you don't have to connect it to anything internally in the supply! It's basically just a splicing point for one of your multimeter's test leads, and the lead that will feed voltage to the equipment or circuit under test. It's the simple and safe way to put your multimeter in series with the device whose current you'd like to check, and **Fig. 4** shows the concept graphically. When you don't want the multimeter in series with the bench supply, just connect a short from the power supply's negative post to the dummy post and you're back to the old days!"

Moderator's note: I'll have to admit that this solution to clip-lead clutter never crossed my mind ... great suggestion, Peter!

Family (of) ties

Back in the October 1996 "Ham To Ham" column, I described one possible method of making your own cable coil ties from standard hook-and-loop sew-on strip material, available at most fabric and variety stores. A reader recently sent me a sample of a find that he came across for prefabricated cable ties, using an even better material ... double-sided Velcro™.

From Charlie Smith KE4OZN: "I recently ran into a great product that I use almost every day and I know that other hams would do the same if they knew about it. They're one-piece cable ties using the Velcro loop & hook principle, but with an interesting twist. Grip Strips™, as they're called, are made from strips of double-sided Velcro, i.e., the top side is the 'fuzzy' or 'looped' side, the opposite side is the 'pinchy' or 'hooked' side. The material has this double-sided feature throughout its entire length. It can be wound around a cable coil or power tool cord, and then attached to itself, to hold the cord in a neat coil for storage or transport. Grip Strips, made by GB Electrical, Inc., 6101 N.

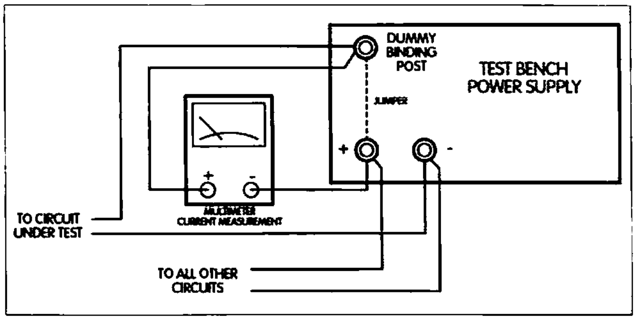


Fig. 4. NØBLX's tip for keeping your test bench a bit more free of clip-lead clutter with the use of a dummy binding post on the bench power supply.

Number 55 on your Feedback card

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

New modes!

Many of us who write in the ham radio press make comments to the effect that there's lots of uncharted technological territory for hams to explore, and we should all get cracking! We try hard to get everybody all worked up, but we never seem to actually suggest any of these miraculous new modes. I've been thinking about that for a while now, and I've come up with a few I think might actually work and be very useful, and which can be played with by any reasonably technically competent ham. So I'm going to propose a couple of new ways to communicate. Who knows? Perhaps one of them will change the face of ham radio! Even if they don't, they're food for thought.

Packet voice

Have you seen the new digital cellular and PCS phones? They get much better battery life than regular, analog phones, which are basically the same technology as our FM HTs. Why? Because they don't transmit continuously! Instead, they transmit their digital information in bursts, with the resulting duty cycle of transmission being far less than the 100% required for regular analog voice transmission. Of course, it's the transmitter that kills the batteries, so keeping its duty cycle down boosts battery life enormously. That's what makes those new ultra-small phones practical.

Does this transmission method sound familiar? Yup, it's the same thing we've been doing with packet radio for years! The difference here is that they're sending voice data, not text. (Well, OK, some new phones offer text messages, too, but that's not the point here.)

Why can't we do the same thing over our repeaters? I propose an experiment like this: Make a digital controller for a two-meter, 220, or 440 MHz radio. Have the controller digitize the voice and then packetize it. Then, have it blast the data over a standard FM rig, using a normal voice or packet repeater for relay. The connections between the radio and the controller would be essentially the same as with any present packet setup. The big operating difference would be that the PTT button is connected to the VNC (voice node controller—cute, huh?) instead of directly to the radio. Otherwise, the whole thing would be transparent.

So, while you're talking, the controller would be cycling the transmitter on and off. In this type of use, it might be a good idea to disable the acknowledgment part of the system, to avoid having the repeater tied up with all those "acks." If you're not solid into the repeater, you'll simply drop out, as with regular FM. Of course, if you want to get fancy, you could have the repeater send you acks, and then you'd *know* whether or not you were making it into the machine, even while you were speaking! An indicator on your rig would come on, letting you know when you weren't making it. How's that for cool?!

This system could employ the digital equivalent of CTCSS, too. In unconnected mode (to use the present packet radio terminology), everyone could hear your transmissions, and you could hear everybody else, too. That would be the normal mode of use, and would allow roundtables and such, just as we have now. If you wanted to get rid of others' transmissions, you'd just select "private" or "connected" mode, selecting from perhaps 10 codes, numbered one to 10. (You and the station with which you wanted to communicate would simply select the same code.) Everyone could still hear you (after all,

---

Baker Road, Milwaukee WI 53209, come in three lengths (eight, 11, and 15 inches long) and in three colors (red, green and black) for different sizes of coils and to quickly identify different cables. The 11-inch size (an all-around handy size), in red, is designated as 45-V11RD. They're available in the electrical supply departments of many hardware stores and larger home centers for about $2.50 to $3.00, depending upon their length, for a package of five. That's less than $1 each, which I feel is well worth the expenditure, since they should last at least as long as the cable itself ... maybe longer! Grip Strips have a widened design at one end, which also has a cutout slot for self-storing the tie right on the cabling, but I prefer to utilize a small (four-inch) plastic cable tie or two to make sure that the Grip Strip stays with a particular cable or power tool permanently. The strips can easily be cut to a smaller size, so you might want keep a stock of the longest ones as a norm. I think that once you've tried these little gems, you'll 'stick' with them!"

Murphy's Corollary: Whatever it is that you want to do, you must always do something else first that you *don't* want to do.

The "Ham To Ham" column is here to provide a forum for your ideas, even if they may be, well, a little different. Different can often be very creative, and those are the ideas that I really enjoy receiving and including on these pages. Don't worry about your writing skills—just include as much detail as you can and I'll put it together in the style of the column. Let's hear from you!

As always, many thanks to those who've contributed to this month's column, including:

Roger Block, President
PolyPhaser Corporation
2225 Park Place, POB 9000
Minden NV 89423-9000

Tom Siolek N3VUF
32 Westwood Park Drive
Havertown PA 19083
[n3vuf@aol.com]

Peter A. Bergman NØBLX
3517 Estate Drive SW
Brainerd MN 56401

Charlie Smith KE4OZN
12900 Meadow Creek Lane
Apt. 204
Pineville NC 28134

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included to the moderator at the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

privacy goes against the spirit, and the law, of ham radio), but you wouldn't hear them, just as with present-day CTCSS. And, if someone else wanted to join in or make a comment to you, all he or she would have to do is select the same code, which would be displayed on all receivers whenever either one of you was speaking.

And, unlike with analog CTCSS, multiple codes could be employed. Why do that? Well, one code could be for the repeater itself, for the purpose of avoiding mutual interference, as is done now. But, the digital system would allow you to add another code for selective calling.

Another very cool feature of this system is that multiple users could share the repeater without bothering each other, which is something unthinkable in the analog realm. All that's required is for each station's controller to avoid transmitting when the channel is busy, resulting in automatic interleaving of signals. Of course, just as with regular packet, things will bog down dramatically when the channel is busy, and some collisions may occur (although these should be much rarer than with traditional packet, since everyone presumably can hear the repeater). The faster the data rate, though, the shorter each blip will be, making the channel available for more and more traffic.

Obviously, this isn't going to happen at 300 baud. To get usable voice transmission, a minimum of 9600 baud will be required, at least by today's digital compression standards. But we already have 9600-baud packet modems, so that shouldn't be a problem. And, more efficient data coding may lead to less data per second of speech, easing the bandwidth problems down the line.

Initial experiments can easily be done with current packet gear and normal voice repeaters, although some modifications may be required. In particular, the repeaters might need to have their long squelch tails chopped off, to avoid bogging the system down. And, of course, you'll have to build something to digitize the voice and compress the data before you feed it to your VNC, but modules to do that are commercially available in the computer telephony market right now. Remember, you don't need high-quality sound here, so the digitizing doesn't have to be complex or expensive. There are plenty of hobby-level A/D converters out there for next to nothing. As for the data compression, initial experimenters can use their home computers. OK, so it won't be very portable at first. Eventually, I foresee the digital controllers integrated right into our HTs and mobiles, just as they are with digital phones now. The rigs will look just as they do today, except perhaps for a new command or two on their menus, and their blinking transmit lamps!

I suspect that a mode something like this one is the future of VHF/UHF ham communications, and I predict that within 10 years we'll all be using it. In fact, I predict that packet radio, currently languishing under the onslaught of the Internet, will eventually be looked upon as the pioneering infrastructure which eventually led to this leap into modern voice communications. OK, it's nearly the new year as I write this, so I'm permitted to make some foolish predictions!

Walk 'n' look

Why limit such a powerful technique to voice? There are digital videophone devices out there right now that can send full-color images, at 15 frames per second or so, over analog phone lines, using 33.6 kbps and 56 kbps modems. Why not put together a "walk 'n' look" system which can send a few frames per second of color video over the same radio channels I just described, along with the voice? We don't really need 15 fps, at least at first, so we could get by with slower modems. (Sending high data rates is harder over radio channels than over the phone lines anyway, due to noise and phase problems.) Using today's tiny CCD cameras and those lovely active-matrix color LCD panels found in the better pocket TV sets, you could have a powerful ATV system and carry it around in your pocket! And, unlike today's analog ATV, it wouldn't require tons of bandwidth or lots of power. I, for one, find the prospect of digital, pocket-sized ATV very exciting.

Shoot the bird

Once you have a packetized voice and/or video system in place, why limit yourself to terrestrial repeaters? A lowered-duty cycle technique like this is a natural for satellite relay. If it got popular, dedicated, miniature amateur birds would undoubtedly be launched. Hopefully, some would be geostationary and have sensitive enough receivers that no pointing or high-gain antennas would be required on the ground. Plus, with the interleaving inherent in the system, many people could share the birds at once. Whip out your HT or video HT and connect with somebody halfway around the world. Fun, huh?

Wanna try?

Anybody out there want to try some of this stuff? Alas, as a struggling musician, I simply can't put the time into it myself, much as I'd love to. If you do try it, send me a note detailing your progress, and I'll put it into a future column. Remember, we hams aren't finished innovating, not by a long shot!

Until next time, 73 de KB1UM.

QRP

Low Power Operation

Michael Bryce WB8VGE
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Picking up where we left off last time …

Let's hope that by now your HW-8 is working just like it should. But deep down inside, you feel there's something missing with the little rig. Well, the HW-8 is a great platform for adding your own modifications! In fact, I've seen some HW-8s with so many modifications, it's hard to the believe the rig *was* once an HW-8! If you've ever seen Adrian Weiss WØRSP's HW-8 Super Contest Machine, you know what I'm talking about.

HW-8 modifications

There are lots of tweaks and peaks you can do to enhance the operation of the HW-8. However, before we get the soldering iron hot, I've found some goodies any Heathkit owner will want to know about.

First, the green paint used in almost all of the Heathkits was really put on thin. Scratches in the paint were a fact of life if you ran Heathkit equipment. I've found a company that sells "Heathkit green" paint. It's from a company called R&R Designs, 202 Midvale, Marshall WI 53559. (800) 372-4287. E-mail at [rehummel@aol.com]. A 12-oz. spray can is $14.95 + $3 shipping. They also have touch-up bottles, and if you're *really* into Heathkits, you can buy the paint by the gallon! They have several colors, so be sure you ask for the one matching your HW-8.

I guess if you're that taken by the HW-8 and Heathkits in general, you should also be reading the *Heathkit Journal*. It's $25 per year in the US and $30 in Canada. It's by the same people who sell the paint, so the address and phone are the same. However, the 800 number is for orders only. If you have questions, call Robert Hummel at (608) 255-0400.

Let me make this clear. I have not ordered, nor have I tried to use, any of the paint products above. Also, if you're not up to the task of repainting a cabinet, perhaps you should pass on the project. Personally, I'd practice on someone else's HW-8 first!

If you need a manual or schematic for your HW-8, the only authorized source is, of course, Heathkit. Give them a call at (616) 925-5899.

And now the modifications

Before we begin, your HW-8 should be in working order. Don't do any of the modifications if the rig is sick—and do only *one* modification at a time. Completely check the HW-8 for proper operation after the mod is made before moving on to the next one. While the modifications presented here are simple, some of the complex modifications conflict with other modifications. And lastly, if you don't know what you're doing, then don't attempt *any* of these modifications!

Meter lamp

This is a classic, and perhaps the easiest to do. Basically, you add a small grain-of-wheat lamp behind the meter. You can get these lamps from your local Radio Shack™ store. Check the many surplus electronics mail-order places for the best price and selection. Add power to the lamp, and the meter takes on a nice warm glow.

There are two ways to power the meter lamp. One is to pick up +12 volts from the rear of the power switch. This applies power to the meter lamp whenever power is applied to the HW-8. However, the HW-8 uses a multi-pole AMP connector for power. I've rigged up the connector to supply power only to the meter lamp when I'm using an external AC supply or my large battery bank. A second power cord was wired to bypass the meter lamp when operating in the field from a smaller battery. All you need is a spare connector and a few pins and sockets for the AMP connector. Again, Radio Shack carries these connectors. Plan how you want the pins and sockets installed into the nylon heads. If you screw up, they're damn near impossible to remove without the proper tools.

If the meter lamp is too bright for your liking, add a small current-limiting resistor in series. A solder lug strip is easily added. Use a solder lug strip having at least five lugs … well, use it in the next mod. Remove the nut from the screw closest to the VFO knob holding the meter in place. Remove the single solder lug (it's the bent one holding the meter) from this nut as well. Solder a bare wire about three inches long to this lug. Replace the lug on the screw. This is our ground connection. Whatever you do, don't try to solder to this lug while it's still touching the back of the meter. Heat from the soldering iron will cause the back of the meter to melt. If that happens, you're in really deep dung! I know of no sources for replacement HW-8 meters. Use the solder lug strip to hold your current-limiting resistor and the grain-of-wheat lamp itself. The lamp's leads hold it in place. You can bend the leads to suit the amount of light the lamp places on the meter's back side. Replace the top of the rig, turn off all the lights in the room and fire the little guy up. Now, sit back and enjoy your handiwork! After a few minutes, don't you wish that meter did something besides just sit there and glow? Well, that's the second modification—adding an audio-driven S-meter to the HW-8.

An audio S-meter for the HW-8

This is a classic modification. I've seen several, but this one is simple and it works. Nothing fancy—it just makes the meter's needle move. The stronger the signal, the more the needle moves. The circuit does not provide any AGC to the receiver. During transmit, the S-meter's circuit is transparent to the HW-8 circuit used to drive the same meter to indicate transmit power. This circuit is simple and effective.

In a nutshell, here is how it works: A sample of audio is picked up from the high side of the HW-8's volume control. Diode D1 rectifies the audio and directs it to an RC circuit. This RC circuit consists of R1 and C1. CI has more control than R1 and it's best to change the value of C1 rather than R1. A lower value at C1 will give a quicker response to a signal. Any value from 10 µF to 47 µF will work.

Resistor R2 isolates the S-meter circuit from the transmit circuit on the HW-8's PC board. Don't drop this value lower than 10 k. The value shown, 12 k, provides a nice action.

Diode D1 is a 1N914. However, if you want your meter a tad more sensitive to weaker signals, a 1N34 diode should be used. If you do, then you may have to experiment with the value of R2, increasing its value to prevent pinning the meter's needle with really strong signals.

If you did as I said, and installed a multi-solder lug terminal strip, use this strip and point-to-point wiring to assemble the S-meter. While there are no adjustments to be made, you may want to fine-tune R2 and C1 to achieve the desired operation.

Number 58 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/5
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[pangen@compuserve.com]

Mobile antennas

I tend to have a love-hate relationship with antennas. I love how a good antenna can make operating a dream, but I hate the gyrations sometimes necessary to install it successfully, especially given my interest in mobile and other non-permanent installations. While stacked monobanders at an altitude which approaches major airline routes provide optimum performance, they are in no way mobile. The more mobile an antenna, the less one expects it to perform. I decided, therefore, to look at antennas which can provide reasonable performance while also being easily installed for mobile operations.

My first choice was to pick an antenna for two-meter/440 MHz operations that would be easy to install, operate reasonably well, and, out of deference to the XYL, be relatively inconspicuous since it would be attached to her car. Initially I attempted to use a magnetic mount on the trunk lid so that it could easily be stowed in the trunk when not in use. Unfortunately, many of today's cars have much less steel than one might expect, and the magnet found absolutely no attraction to the trunk lid. Plan B was for a glass-mount antenna, although my expectations for this option were quite low. I had tried glass-mount antennas in the past, but the emergence of metallic-based tinted (sometimes called passivated) glass prevents them from working well. I had hoped that, as cellular telephones became more developed, the technology for through-the-glass antennas had kept pace. Cellular antennas, after all, are almost universally glass-mounted, and appear on every type of vehicle imaginable.

After looking through a number of catalogs, I found that Radio Shack™ sells one that covers both two meters and 440 MHz. This turned out to be a stock item, rather than one that needed to be ordered, so I purchased one from the local store and decided to see if it would work.

I started by attaching the antenna to the rear window glass with masking tape. This is not quite as easy as it sounds, since it took about six strips of tape to support the external mounting block and antenna plus a few more for the internal block. After getting everything lined up, I used my handie-talkie and UHV/VHF SWR meter to check the SWR at low power. I was getting 1.5:1 or better throughout both bands, so I decided to install the antenna permanently. To be successful, it is essential to make certain that the glass is clean before mounting the antenna. Most household glass cleaners contain silicone which will inhibit a good bond, so they are not the answer. The package contains an alcohol swab with which to clean the window, and the alcohol when mixed with generous amounts of elbow grease will ensure that the antenna will stay put. I carefully lined up the outside block so that the antenna was as vertical as possible. Once I was happy with its alignment, I removed the backing from the adhesive pad and attached it to the glass. This must be right the first time, because the glue will not let you move the block once it is attached. It was now easy to line up the inside block, attach it, and then route the coax to the front of the car. Because of a curve to the rear window, it was necessary to place a very small bend in the antenna shaft, but I decided to wait a few days to give the glue time to cure before I started making mechanical adjustments which might disrupt the seal.

> ***"Installation was not difficult, although some of the directions were in Japanese."***

I located the tuning tool that came with the antenna, and prepared to adjust the antenna. I was pleasantly surprised to find that when I transmitted,

Reverse polarity protection

I won't take too much time, but needless to say, the HW-8, like so many other rigs of its day, did not provide any protection if you connected it up backwards. Several months ago, I showed you some modifications to Ten-Tec's QRP rig. They work just as well here in the HW-8.

I prefer to use a three-amp diode to ground. If you reverse-connect the rig, the diode conducts and blows the power line fuse. I don't like cutting holes in an HW-8, so an in-line fuse holder works for me. Also, I don't care for the AGC type of fuses during portable use. Instead, I like the ATC type. These are the same types you'll find in all the new automobiles. Radio Shack sells an ATC in-line holder for a buck or two. They also carry the low-amperage ATC fuses as well.

If you have to remove the PC board from the rig, there are two more modifications you may want to do. Both center on the RF amplifier in the receiver's front end.

The first mod ensures the front-end amplifier, Q1, is turned off during transmit. This modification prevents damage to Q1 by routing +12 volts from the top of the T/R relay. When you key the HW-8, the end result is that Q13 conducts and sends +12 volts to the T/R relay's coil. By tapping this voltage and applying it to Q1, we can cause the amplifier to shut down. A small signal diode and a 22-ohm resistor are all that is needed for the modification. A sleeve of heatshrink tubing can house the two parts. Tack-solder them to the bottom of the PC board. You'll need to run a small jumper from the relay coil to the diode/resistor combination.

Increased sensitivity for the HW-8

Although I found my HW-8 to hear just fine, many other hams have reported lackluster sensitivity. A simple fix is in order for improved sensitivity. Remove Q1 (the MPF 105) and replace it with a 2N4416 FET. The 2N4416 has one extra pin that is unused in the HW-8. This extra pin is the ground connection for the case of the 2N4416. You can either leave it "floating" or drill a small hole in the PC board for it and ground the pin.

W1FB—SK

If there is one drawback with writing a monthly column it is the lead time between publishing day and breaking news. Having said that, by now most of the QRP family has heard that Doug Demaw W1FB is a Silent Key. It's kind of hard not to mention QRP, or home-brewing QRP equipment, without mentioning his name. Doug will be missed.

Number 59 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

Freebies in ham radio: Here's a good one, but you will work for it!

This month, there are several areas to cover, but I will try to be coherent. It just seems that so many things depend on the order of other things to get done before you can start the new fun project.

Last month, I promised myself openly in this column that I would get the PCFlexnet software up and running. Well, I did. There were a few skirmishes with other associated elements in this digital kingdom, but I will begin by telling you how far I advanced along the trail toward a non-TNC, no-modem, simply-a-soundboard packet system.

The PCFlexnet group has a Web page at [http://dl0td.afthd.thdarmstadt.de/~flexnet/]. There, you will catch the vision of a remarkable approach to digital communications. They have engineered at least ten software modules that can coexist to facilitate communication via packet (and other modes to come) on a variety of platforms.

Most of us were introduced to packet radio on the premise that you buy a terminal node controller (TNC), cable it between the radio and computer, load a terminal program, learn about configuration, and put it on the air. This still works for most of us, and the Flexnet system supports and improves on that method.

The next innovation was a software-intensive packet system that worked with a simple serial modem (e.g., BayCom). The cost and size of hardware suddenly shrank. Flexnet modules support this also.

You will recall that in January this column featured my experience with SSTV. The first trial was with a serial modem using the JVFAX software, then with the W95SSTV, which worked superbly using the soundboard in my computer with no external hardware between the computer and the radio. Flexnet modules make this possible for packet.

Runs under Windows 95™

Now here is a plus. Much of the software from Europe has worked well in DOS, and the warning has been that it will cause erratic problems if you attempt to run it under Windows™ (trust them—it does). Flexnet also makes this statement, and it is an inconvenience for most of us. But they have fixed that nagging problem with a Windows 95 Add-On Package.

The scope of all this appears overwhelming at first. I am writing this with a dozen of their most pertinent printouts sitting before me, totaling over forty pages, and there is much more. I also have some instructions forwarded by Paulo CT1DTA, who is an avid proponent of the packet system he is running with Flexnet through a serial modem.

Where to start?

Last month I downloaded several archives and decompressed them. After scanning through the documentation I had printed, I determined the necessary files I needed from these archives. Although loading the modules with a batch file was recommended, I started experimenting by loading them manually in the sequence the advised batch file would have done it.

It didn't work the first few times. I had all the files necessary, plus about as many more, but I had placed them in three separate directories. They all needed to be in one

---

the reflected power needle did not budge on my SWR meter. In actual operation, this antenna has consistently performed better than my expectations.

Naturally, for HF mobile operations, one can expect more challenges. Once again, I wanted a system that would be easy to install, although I was not as concerned about keeping it inconspicuous since this would be on my car. I did wish to avoid making any permanent changes to the car such as drilling holes in the visible parts of the body. I also wanted an antenna that would provide a low enough profile for me to drive through most parking garages without the need to remove the mast. I spoke with representatives from several companies to get their perspectives on antenna options. The prevailing opinion was that a mount needed to be attached to the car's underbody, a trailer hitch or a permanent ball mount, to be workable. This did not fit with my expectations, so I continued searching. After a while I did find a trunk lid mount and antenna that I thought might meet my needs. Comet Antennas™ offers a choice of heavy-duty trunk lip mounts, as well as single- and multiband HF antennas. Several of the mounts allow the antenna position to be adjusted through a wide range so they can be used not only on trunks, but also hatchbacks or even rear van doors.

I decided to try the single band QE line with a 20-meter resonator. Since much of my HF operating time is while going from one appointment to the next, I tend to stay on 20 meters. This also allowed me to meet my height restriction since the 49-inch antenna, when mounted on the car, results in a total clearance requirement of seven and a half feet, which will clear most parking garages with room to spare.

I suspect that in the future I will add resonators for 40, 15 and 10 meters. These can be switched using the quick disconnect feature of the antenna mount. This quick disconnect is also useful for minimizing theft or vandalism problems since the resonator can be released quickly and stored out of sight.

Installation was not difficult, although some of the directions were in Japanese. Most of the installation process is almost intuitive. One thing that you must remember is that the trunk lid must be RF bonded to the rest of the car body in order to act as a ground plane. I used a short length of braid removed from RG-8 coax to connect the trunk lid and car body and it seems to work well.

Naturally, the proof is in the performance, and so far I am pleased. Although it is difficult to compete on a power basis with stations running a kilowatt into a beam, I've already had stations at the other end of a pileup respond to the "eight mobile" even though there were more powerful signals from which to choose.

Personally I prefer to rag-chew, so I don't chase as many contacts as others. On the other hand, I do expect to be able to maintain a contact for a 20- to 30-minute QSO without struggling to hear the other station, and so far this antenna is doing a fine job. If you have a chance, check out 20 meters during the day and we can compare notes.

directory. Fine, I put them all together. Still didn't cooperate, but it was to a point where the Windows 95 Add-On would load.

I have First Aid Windows 97™ installed. It came up and said there was a missing file. Upon clicking the "Fix it" button, it found the file and installed it in the right place. That still wasn't enough, but it was getting closer. The next time around, I got an automatic listing while in the DOS mode that two drivers were missing.

Strangely to me, I could locate those files with the Windows explorer utility, but it couldn't copy them. So I windowed out to DOS and it was a snap. Things began to look up. This wouldn't have happened if I had placed all the files in one directory, but I have a problem with mixing everything all at once. Too many things without a rigid hierarchy seem to muddle this mind and, occasionally, the computer.

Just one more time to shut the computer down, start it in DOS mode, load the modules in the order that works, start Windows and load the 95 Add-On. Got through all that with no errors and the promised PCFlexnet icon was in the task bar.

Does it work?

The next test was going to be a little difficult to evaluate. As usual, there are missing pieces to the puzzle. I had loaded the serial modem driver, but my VHF serial modem is unable to transmit and the project to build a new one is only slowly taking shape.

With the serial modem plugged in and the radio tuned to a node that sends a beacon every 10 minutes, I waited for an indication. According to the LED on the radio, there was a signal, but no screen display. However, there seemed to be some action in the corner of the Winpack program that simulates LEDs.

Another 10 minutes went by and when the next beacon was sent, there was a definite flicker on one of these LEDs. I called that a sign of success. It has a way to go, but I know if we got this far, we can conquer the next hurdles.

It will take a little hardware, too

If you read some of the comments by Tom Sailer, who has a linked Web page [www.ife.ee.ethz.ch/~sailer/pcfindex.html] from the PCFlexnet page, you will realize how far into the future the project is looking. He makes some statements about the fact that modes such as packet, AMTOR, and PACTOR will work well through this medium except for a problem of operating the PTT.

For this, a few solutions have been developed. They are described in a document on his Web site with diagrams for simple circuits to make it happen. This is one of the areas I will have to work on, now that I am convinced the software works. Then I can see if the terminal software in the shack will really work as indicated. Just a few more steps and it looks like I'll be home free.

When all is together and running, I can summarize all the steps and get as close to step-by-step as I know how, so you can try it yourself. It will be fun. If you read into this what I do, this is the digital wave of the future. The problem at this time is that it hasn't been packaged for plug 'n' play. I have an engineer friend, who tells me that where he works, that phrase is pronounced "plug 'n' *pray*." It will be a while before that level of sophistication arrives. But as they say, this is a hobby and, therefore, how you and I have fun.

Now for some of the other computer-related happenings around the shack that may be good to store in the back of your memory. Some of these things really slowed progress for the past several weeks.

Some complications

One of the disgruntling things to happen was my inability to log on to the local ham BBS lately. You would think that would be a simple problem since the BBS antenna is just a few miles across the valley and I have such a variety of hardware and software.

Everything appeared in working order. My station could copy the output from the BBS perfectly on the screen. When my radio sent a connect request, it read perfectly across the BBS monitor. Then things fell down. They just couldn't do the handshake. The BBS would respond with the proper acknowledgment but my system would continue to send connect requests and seemingly ignore the packets being sent from the BBS.

With the sysop, Martin, on the landline, we used separate radios to monitor the sounds of the signals. His sounded strange to me and mine sounded strange to him. We went to voice mode with my radio and my signal would break up. I tried a different radio and it seemed to cure the breakup but was weak. I decided that was due to less power and possibly a mismatch along the feedline.

The next day I tried a few experiments. With each of two different antennas in place, the connection problem persisted. With an old IC-2AT plugged in, there was still no connection, but suddenly this little radio was registering much more power on the wattmeter than the 10-watt radio had been.

Found it!

The test antennas were on a different piece of coax but were much lower—about six feet off the driveway. When I plugged in the regular coax and antenna to the IC-2AT to take advantage of the increased height and gain, the BBS came up and connected, first try.

Obviously, the problem was the radio, but it was working just enough to fool me and probably most casual observers. It is getting ancient, but is a good all-mode two-meter rig I feel is worth repairing. The real clue was the wattmeter. It is an old Swan meter that requires calibration. Therefore, you can get any reading you set it for, so, on its own, it is not a standard. You only know there is a problem when you compare to another radio of (hopefully) known quality.

Update for Winpack

In my quest for knowledge, I often check the Hamnet forum on CompuServe. It seems the folks at CompuServe feel pressure to get new, flashier effects by continuously changing their software. I do not like to use the CompuServe software because, though it works every time, it is very slow compared to my favorite program, Tapcis™.

Tapcis is light-years ahead in speed and utility. The problem is that every time CompuServe makes a change the aftermarket software folks have to match it in order to remain compatible. Again, it was time to tweak the software. When I finally got to Hamnet, I happened on an update for Winpack, version 6.3.

I installed that, though the author claims the changes are simply improved utilities and, if you are having trouble, the update won't fix a thing. Well, hello: The update made the program so stable, I will recommend it as excellent shareware for packet running under Windows.

They are claiming improved performance with the serial modems and capability to interface with PCFlexnet. The screen didn't change perceptibly to me, but I took a screen shot with it running during a session and with the pop-up Flexnet menu in place. The point is that I haven't found a program with a conflict while Flexnet is running. The packet session was running directly through the Comm port to the TNC (see **Fig. 1**).

Another challenge entered my life when my daughter gave me an old hand scanner which she had replaced a few years ago with a flatbed (the kids are always ahead of me in the yuppie devices department). Anyway, this worked, but the images

Number 61 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

Radio foxes don't howl

Is the weather warming up where you live? In just a few weeks, winter will be over and discussions at your local ham club will turn to ideas for outdoor activities. Who will be Field Day chairman this year? Shall we have a barbecue? How about a spring hamfest or picnic? What can be done that's different to attract newcomers and bring back the folks who have drifted away?

Everybody loves mysteries, so why not have a club picnic in the park this spring and include a bunch of hidden transmitters for everyone to find? Better yet, why not make on-foot direction finding (also called foxhunting, foxtailing, radio-orienteering and ARDF) into a new club project?

Foxtailing seems like a well-kept secret here in the US, but in many parts of the world, it's an important sport. Some say it's bound to become an Olympic event eventually. Just like orienteering, formal foxtailing meets involve maps, compasses and stopwatch timing. There are records to be broken and medals to be won.

Formal rules for ARDF are set by committees of the International Amateur Radio Union (IARU). There's no space this month to go into all the rules and practices of the sport, but you can read all about it in past "Homing In" articles such as "FARS, Friendship, and Foxhunting" in the January 1998 issue of *73*. You will also find lots of details about ARDF at the "Homing In" Web site listed above. This time, I'll focus on fox transmitters and how to make them quickly and inexpensively.

Ammo source becomes RF source

Foxtailing in Europe and Asia is done on 80-meter CW and two-meter AM. Right now, almost all ARDF activity here in IARU Region 2 (North and South America) is on two meters, using continuous FM carriers with tone-modulated CW (MCW) instead of AM. It is anticipated that the official Region 2 IARU foxhunting rules, when finalized, will favor FM over AM because of FM's widespread use and the preponderance of FM receiving gear here.

Typical IARU-style hunts have five foxes spread out in a woodsy park. A radio-orienteering fox (foxbox) consists of a transmitter, battery, antenna, and controller. The controller generates Morse Code signals and station identification according to IARU standards: MOE for fox #1, MOI for fox #2, MOS for fox #3 and so forth. Foxes must transmit for 60 seconds each in perfect sequence, one after the other in numbered order. Controllers provide this

---

were coming out very narrow. I determined the images were close to scale if the scanner was moved at the incredibly slow speed of one inch per minute. Perhaps I can build a mechanical drive to accomplish such a speed.

Tape backups—going out of vogue?

A small tragedy resulted from this encounter. By the time I jockeyed the I/O addresses, DMA, and IRQs around, my computer lost contact with the internal SCSI backup tape drive. The nature of this setup seems to be that I cannot find a way to change the settings back to work the way they used to, even with the board for the scanner removed. Just too many toys in a system that is reaching its limit.

This wasn't the end of the world. The capacity of the tape drive was becoming lackluster after several years of service, and I could justify an external drive. Then came an awakening. At the store, as well as in the catalogs, there is little evidence of tape drives anymore. Times have changed. It looks as if the highly touted 100-megabyte removable disk drives have taken over.

That looks like a good way to go, but I prefer a drive capable of making an unattended pass where I am not shuffling disks. I came home with the only tape drive easily available, hoping my old software would suffice. The plug-in process for the hardware was very basic—the drive cables to a parallel port and daisy chains to the printer.

The included software was a kick. It turned out to be what must be the only major name brand left, Seagate™, which is what I had been using in a slightly different format. Very nice. With the CD in the drive, the setup process begins automatically and a message appears saying backups will be happening in five minutes.

I waited several minutes, watching little emblems rotate on the screen before realizing it needed one of those emblems to be clicked. Then the installation really began. I had sweated it a little as I read the minuscule documentation that spoke of I/O addresses, DMAs, and IRQs. But that must have been for a DOS installation. The program figured all this out on its own and a backup was in progress in about 30 minutes.

I mention this because, even after the industry reduces every aspect of running a computer to plugging it in, we are still expected to fill in the blanks and push a few buttons ourselves. And, of course, I wanted to make a few excuses for why I haven't completed the Flexnet project or the VHF modem by now.

Also, as digitally-inclined hams, we should welcome the opportunity to get to the basic nuts and bolts of these modern forms of communication. The thought just occurred to me that I will suffer severe nausea if this hobby is ever brought to the level where it is run by a remote control "flipper." I cannot stand to be in the same room with a "flipper" and his TV, or, worse, with him when he grabs my remote. Now you know one of my weaknesses.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack Heller KB7NO.

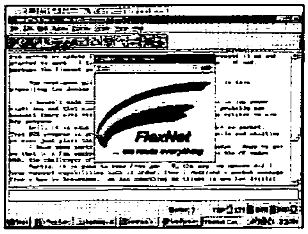


Fig. 1. Screen shot of Winpack software operating with Flexnet running idle in the background. The PCFlexnet pop-up screen is available for special controls and is normally not visible. There appears to be no conflict with other programs when the Flexnet modules are loaded, even when Winpack is active on a Comm port.

Photo A. *Ammunition-box foxes are rugged and easy to carry. They blend in well with surroundings.*

timing, using crystal time bases to maintain synchronization.

At present, PicCon is the only domestic fox controller that meets IARU specifications. It produces timed turn-on/off plus MOE/MOI/MOS signaling in CW with callsign identification. Programming of its non-volatile memory is done with DTMF tones. A complete description and review of PicCon was in "Homing In" for March 1997. Special quantity pricing of PicCons in kit form is now being offered, to encourage clubs to build complete foxbox sets. Contact Byon Garrabrant N6BG at his new address (8128 Kokoma Drive, Las Vegas NV 89128) or check the PicCon Web site via link from the "Homing In" site.

IARU regulations permit foxes to run between 250 milliwatts and 1.5 watts. Powers of all foxes on a course should be within 3 dB of each other. You don't need to follow these rules for your local hunts, but it's nevertheless important to be able to adjust power to suit the course. For hunts in small parks, running less than a half watt will preserve battery life, enabling longer practice sessions. When it's time to try ARDF in a really big park, over a watt may be necessary when a fox is a mile or more away from the start. You may even need to put the fox antenna up in a tree.

PicCon can control almost any VHF-FM transmitter, including handie-talkies. Kits for crystal-controlled or synthesized two-meter FM transmitter boards of about a watt are available from several sources. One is *73* advertiser Hamtronics Incorporated, 65-D Moul Road, Hilton NY 14468; (716) 392-9430.

The cost of five complete foxboxes built from HTs or kits can easily exceed $1000. If your club has that kind of treasury, great. If not, there are many ways to build them on a shoestring budget. For my own project, the biggest cost savings came by using transmitter boards salvaged from surplus 1980s-vintage 151 MHz business-band mobile transceivers. The price was right (free!) and the boards from these Yaesu FTC-1525A and FTC-2025 sets are of quality equal to or better than most of today's transmitter kits.

Check local flea markets and business radio suppliers to see what you can find. Get good documentation from the source if at all possible, because manufacturers' prices for old service manuals are far too high. Fortunately, the circuits of sets using discrete semiconductors are relatively easy to trace, even without a schematic.

For inexpensive, sturdy, waterproof enclosures, it's hard to beat surplus military ammunition boxes (**Photo A**). The size I like (5-1/2 x 11 x 7 inches inside) is twice as big as necessary, but the large surface of the removable lid makes it easy to mount all parts except the battery (**Photo B**). Add provisions for a bicycle chain and lock if you're worried about theft.

Flea markets and military surplus outlets are good sources of ammo boxes. I have even seen them at the "Camo Store" in a mall, but prices were too high there. Don't pay more than about $5 each. Look over the merchandise closely and pick boxes with good lid seals, to keep your transmitter parts dry and prevent corrosion.

Build 'em tough

Over the years, I have learned the hard way that Murphy has a special fondness for foxboxes. There are lots of things that can go wrong when you put a hidden transmitter in a remote spot. You cross your fingers hoping that it will come on at the appointed time with full power and that your batteries will last for the duration. You certainly don't want to have to go out to service it during the hunt, thereby giving away its location.

Photo B. *A completed transmitter inside the lid of its ammo box. The crystal deck and PicCon controller are mounted under a copperclad board, which also provides physical protection for all circuits. The 1/8-inch jack is for DTMF audio input to program the PicCon.*

PicCon includes a delayed startup feature that allows you to put out your foxes several hours before the hunt and have them automatically come on at start time. However, just a few milliseconds of power interruption in the interim will reset the timer. There's no way to tell if this has happened until it's too late, so take extra steps to prevent it. I eliminated all switches between battery and PicCon. Fuse holders can become intermittent, so I made my own battery fuses out of AWG 32 wire and soldered them into the circuit.

My surplus radios had separate 12-holder crystal boards for receiver and transmitter. I used the transmit crystal boards without the switches and their potential for intermittents (**Photo C**). This permits future frequency changes in the field by moving one wire. (You *do* carry a small soldering torch along, don't you?) The coordinated frequency for transmitter hunts in

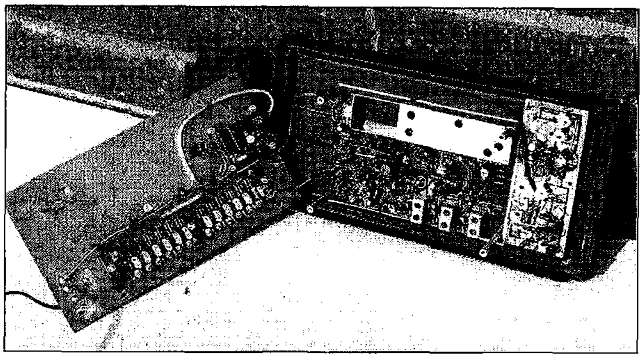


Photo C. *View of the foxbox circuits with the crystal deck and PicCon exposed.*

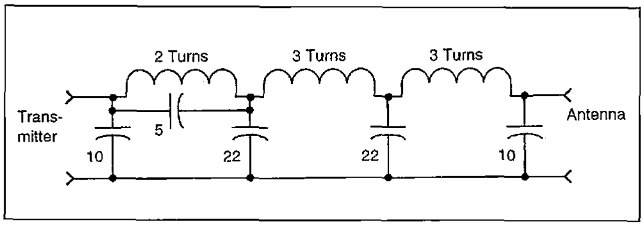


Fig. 1. Schematic of a simple low-pass filter for two meters. Capacitance values are in picofarads.

southern California is 146.565 MHz. This frequency is also popular among other cities in the US and Canada. I purchased five crystals for $50 total, plus shipping, from Cal Crystal Lab, 1156 North Gilbert Street, Anaheim CA 92801; (714) 991-1580.

The Yaesu transmitter board output originally went to a separate heat-sinked 35-watt final stage. Power from the "barefoot" board exceeds five watts, so there was no need to use the finals. An easy and effective way to adjust power on boards like this is to control the supply voltage to the RF stage just preceding the output stage. A variable resistor wired as a rheostat will do it, but there may be a large power change as the battery sags during the hunt. In a quick test with a resistor selected to run an FTC-2025 board at 1.5 W with a nearly charged battery (12.85 volts), the power was only 0.75 W at near discharge (12.0 V). A better solution in my case was to use an LM317 IC to regulate the preoutput stage voltage over the range of three to nine volts, sufficient to adjust from 0.1 to 3 W out of the board. With this regulator, power remains nearly constant as the battery discharges.

Photo D. Low-pass filter section of the Yaesu final amplifier. The potentiometer and diode are part of a reflected power sensor circuit that is not used at present.

Retuning from business band to two meters was a simple matter of installing the new crystal and adjusting each stage from oscillator to output for resonance. The output stage trimmers were set for best efficiency (maximum RF output consistent with minimum current draw). I then used a spectrum analyzer to verify signal stability and purity.

Fox transmitters must follow good amateur practice, which includes suppression of spurious emissions and harmonics. A filter in the output of commercial rigs accomplishes this, but there is no such filtering of the preceding stages. Sure enough, the spectrum analyzer showed that the modified FTC-2025 board output was stable, but second harmonic was only 16 dB down. So I removed the final stage from its enclosure in the transceiver and wired it into the ammo box, passing the transmitter output through just the low-pass filter components. Upon retest, power was the same but all harmonics were well below -40 dB, in accordance with FCC regulations.

Photo D shows the harmonic filter portion of the final board. You can easily make a filter like it from scratch on a 2- x 2-inch piece of copperclad board, using a Dremel™ tool to grind pads for the ungrounded component nodes. **Fig. 1** is the schematic. Wind the coils on a 15/64-inch drill bit using AWG #20 enamel-covered wire, then slide off the bit and install. An attenuation versus frequency curve for this filter is posted at the "Homing In" Web site.

Your transmitters will probably draw between one-half and one ampere from a 13-volt source, so you will need relays or hefty transistors to key them on and off. I found a small relay on each Yaesu board that is just right for keying. Its coil draws 40 mA, which is more than the PicCon keying circuit is designed for. Fortunately, the PicCon switching transistor can handle 40 mA, and more base drive for it is available from the PIC chip. Changing R4 on the PicCon from 10 k to 910 ohms accomplished this.

Select your batteries in accordance with current drain and anticipated hunt time. Let's say that the transmitter pulls 800 milliamperes at maximum power, including the relay coil. If there are to be five foxes in sequence, the duty of each fox is 20%, which is 160 mA on average. The PicCon draws 12 mA continuously, so the battery requirement for a three-hour practice session is 3 x (160 + 12) = 516 mA-hours. Battery capacity diminishes with age, so it's best to add a safety factor of about 100% and choose a one ampere-hour or greater battery pack for this example.

Before shelling out cash for rechargeable batteries, check with the biomedical engineers at your local hospital. Regulations call for periodic replacement of backup batteries in some portable medical devices. You might be able to obtain some used but fully functional sealed lead-acid packs just for the asking.

A simple vertical antenna that's adequate for most small-park hunts is a 19-1/2-inch length of 3/32-inch bronze welding rod in a PL-259 plug. I salvaged SO-239 connectors from the Yaesu radios and mounted them near the center of the ammo box lids, for best ground plane performance of the whips. To clear the protruding terminal on the back of the SO-239 under the transmitter board, I drilled holes in an unused area of each board (**Photo E**).

After the solder fumes cleared and the drilling debris was swept up, I added my expenses and discovered that I had spent only $65 per foxbox. The majority of the total cost was for the PicCon controllers. Not bad for a few evenings' work!

Continued on page 71

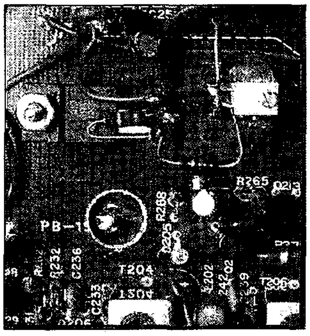


Photo E. The added LM317 IC and potentiometer provide power regulation and control. Below the IC is a hole for access to the SO-239 output connector.

Number 64 on your Feedback card

Ham Radio Fun

Don't Leave Home Without It

An ingenious tester for your wallet or purse.

Glenn E. Yingling W2UW
28 Lawrence Avenue
P.O. Box 62
Newark Valley NY 13811-0062

Picture yourself at a hamfest. You suddenly see the headphones of your dreams and then realize you have no way to test and verify that they are in operating condition. Or perhaps you're at a friend's house and want to test something so that you can be the hero of the moment. At some time you have probably wished that you had some sort of continuity tester with you so that you could check to see whether something is working. I know that *I* have, many times, but because I had forgotten to bring one or did not foresee that I might be needing it, I was not able to perform any test on a circuit.

Well, no longer—not since I have my special "Never-Left-At-Home Tester" in my wallet at all times! With my credit card-sized tester, I can check most everything you can with a standard ohmmeter, including:

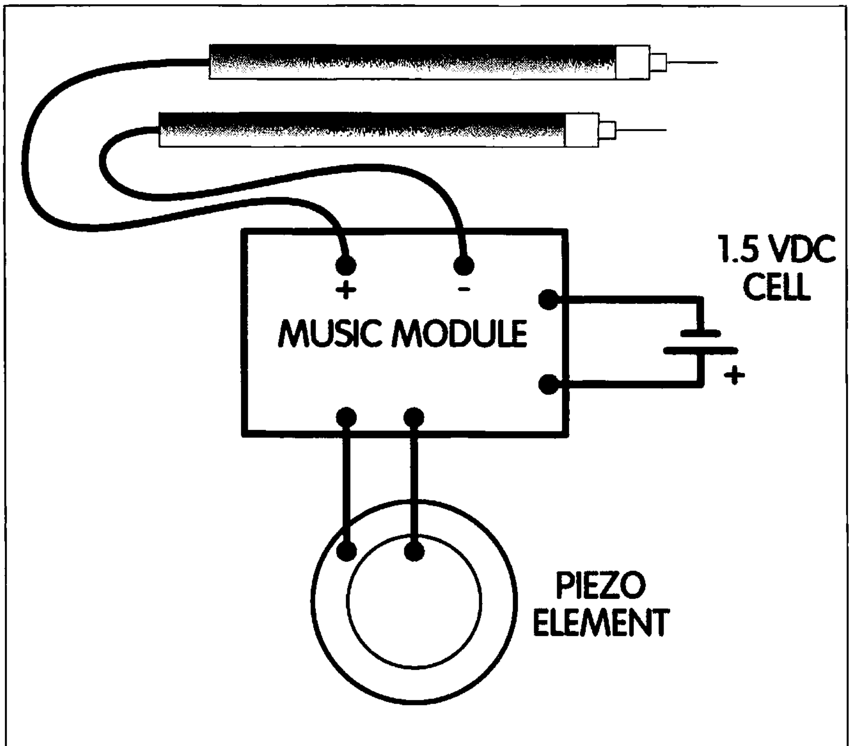


Fig. 1. Schematic diagram of the Never-Left-At-Home Tester. Note: Probes are drawn much larger than indicated in text.

Diodes
Headphones
Speakers
Bulbs
Resistors
Tube filaments
Switches
Coils
Motor windings
Fuses
Transistor junctions
Wiring cables
Chokes
Meter movements
Potentiometers

My tester is nothing more than a music module recycled from a greeting card and attached to a stiff backing about the size of a credit card. These modules come self-contained, with their own piezo speaker element, and operate from a 1.5 VDC watch battery. The attachment of the module to the backing can be made with an adhesive, or it can be soldered to a piece of printed circuit board material. My design uses a Radio Shack™ multipurpose printed circuit board as the backing, with the module soldered to it. I also add two flexible leads with probes to the plus (+) and minus (-) terminals of the music module. I then wrap tape over the whole thing and slip it into my wallet along with my credit cards. Although the tape covers the piezo element, it does not muffle the tone.

My Never-Left-At-Home Tester cost me only $4.07! That's 89 cents for the music module (#G2744, Electronic

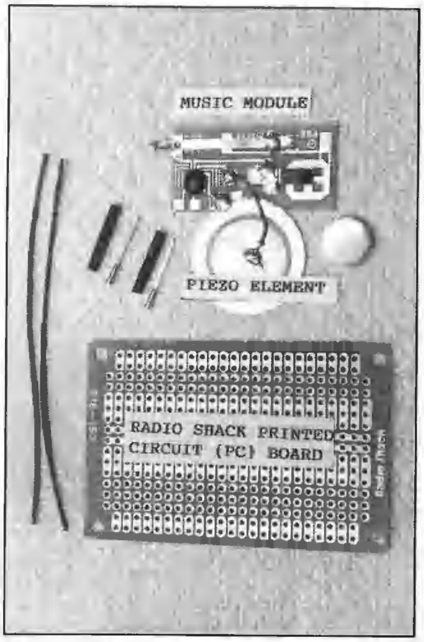


Photo A. Original parts kit.

Goldmine, P.O. Box 5408, Scottsdale AZ 85261); $1.19 for the PC board (RS #276-150); $1.99 for Battery 391 (RS #23-107); and nothing for the solder, wire, tape, and epoxy from my junk box. Of course, you may have to spend a few cents in postage or gasoline.

However, you can reduce this cost quite a bit if you have a friend who sends you a greeting card with the music module and battery included! But if you are short of such extravagant friends, you can still purchase the battery for 25 cents by buying LR44 watch batteries from Electronic Goldmine at two for 50 cents (Electronic Goldmine #G8540). With a scrap piece of PC board for the backing, the total price now adds up to $1.14 (89¢ plus 25¢)! HI! I prefer my approach, though, because the Radio Shack 391 watch battery is thinner (only 0.075 inches) and the RS PC board is easy to work with.

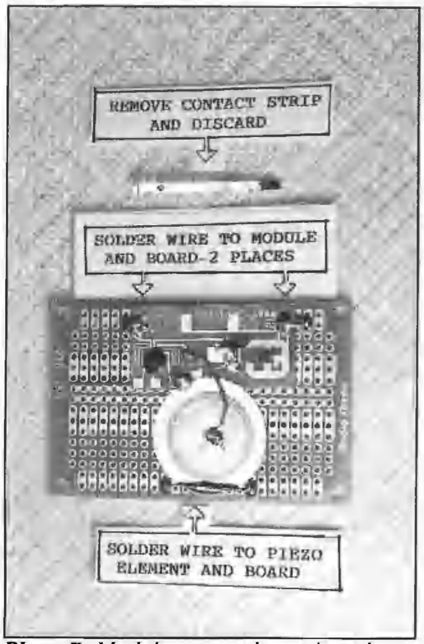


Photo B. Module mounted onto board.

How it works

The principle of operation of this continuity tester is that the two test probes complete the circuit between the 1.5 VDC battery and the music module (see **Fig. 1**). The module then responds with an electronic rendition of that old favorite tune "Let Me Call You Sweetheart," indicating that my circuit under test is in sweetheart shape!

If the item being tested has a somewhat high resistance, the "tune" will become quite distorted. For very high resistances, the tune may eventually stop, but a "buzz" or "tick" will continue to be heard which aids in estimating (through experience) what the impedance might be. I have found that some modules will produce a "tick" with resistances up to 10 megohms. In fact, one module that I tried would "tick" slowly if I completed the circuit through my left and right hands!

There is little danger of causing damage to any circuit being tested, because the battery voltage is only 1.5 VDC and the current through any low impedance will be no more than 1 mA.

Putting it together

Photos A through **D** illustrate the way I assembled the tester. On the music module that I used, there is a flexible metal contact "strap" about an inch long that I unsoldered and discarded. Examine this "switch" to observe where the plus (+) and minus (-) contacts are made, as you will be soldering test probes onto those pads on the music module for its use as a tester.

Photo A identifies the original parts that are used in making the continuity tester.

Photo B shows the mounting of the module to the PC board with three small wires at two corners of the module and at the piezo element. These wires are soldered to the module and the piezo element and then are pushed through the PC board and soldered to the "land" on the plated wiring side of the board. By the way, you may solder a part of the wire directly onto the piezo element with no effects on its operation.

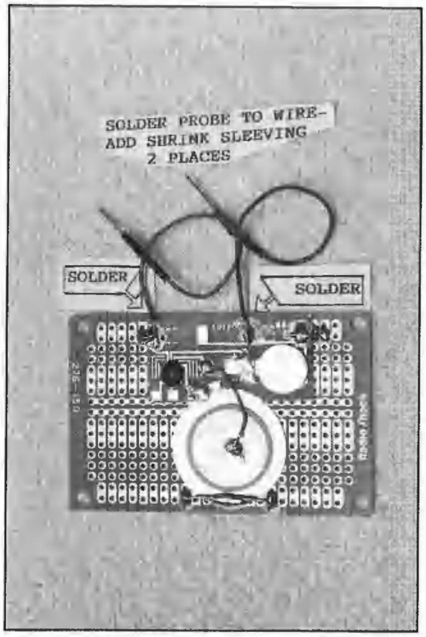


Photo C. Prepare and install test leads.

Photo C shows my preparation and attachment of the two test probes. You

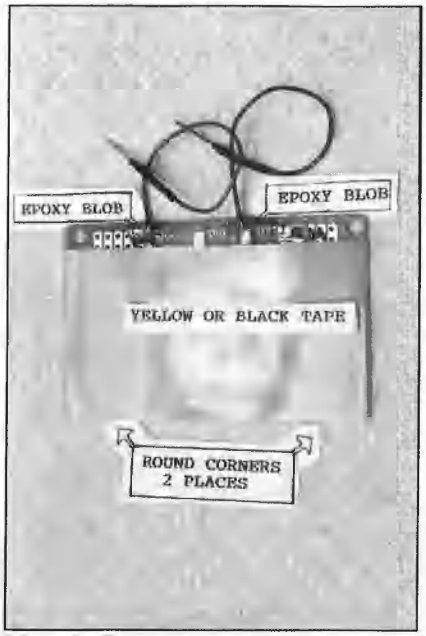


Photo D. Final adjustment.

can use pins out of an old connector that you may find in your junk box. After you have soldered them to your wire leads, you can put shrink sleeving over the solder joints to keep them from breaking. I use very small insulated and stranded wire for the leads since they will be coiled up in the credit card holder of my wallet. I next locate the plus (+) and minus (-) pads on the module referred to previously and solder a prepared test lead to each of them. At this step, I also install the watch battery under the battery contact on the upper right side of the module. If you are installing a very thin battery, it may be necessary for you to bend the battery terminal so that it will contact the battery more tightly.

Photo D shows my completed wallet or purse continuity tester. I put a blob of epoxy on each of the test probe wires at their attachment point on the board to strengthen the solder joint there. Next, I round off the lower corners of the board a bit so that it will slip easily into my wallet. I then wrap the tester with tape. I use the tape wrapping (it can be black electrical tape) to protect the module, keep the battery in place, and (again) make it even easier to slip the tester in or out of the credit card holder of my wallet.

As I stated earlier, you may also attach the module to a scrap piece of PC board with glue or adhesive and forgo the printed card and the soldering of the module to it as shown in **Photo B**. If you choose to do this, don't forget to solder your test leads onto the music module pads as shown in **Photo C**.

I suggest that you use a red wire for the plus (+) lead and a black one for the minus (-). This will aid you in determining the type of transistor junction you are checking and the forward direction of any diodes that you check.

Also, you may use this tester as a code practice oscillator as illustrated in **Photo E**. The first note of the "Sweetheart" tune is so long that you can even send code as slowly as 5 wpm if you desire. The photo shows a practice key comparable in cost to the rest of this project. HI!

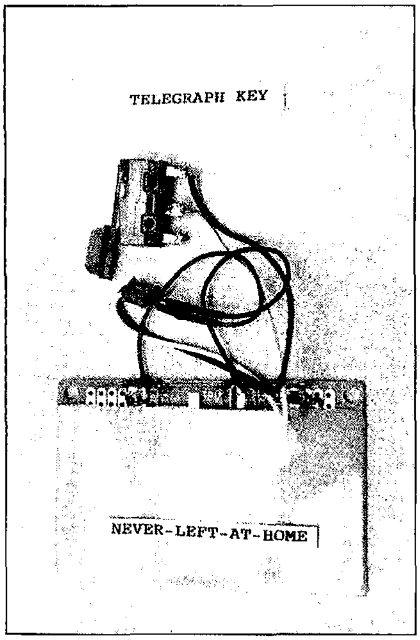


Photo E. *Code practice Oscillator.*

Afterword

We all recognize that it is becoming harder and harder to attract new and particularly younger persons to amateur radio. I attribute this to the fact that there are more and more things that now appear magical to the newcomer and amateur radio has become just one of many. The competition is cellular phones, pagers, TV, VCRs, computers, satellites, the Internet, and so forth. In many of our cases, when we got started in ham radio it seemed like *magic*. It still is to *me* (even at age 70, and a ham for 44 years!), but to today's youth it may be more ho-hum. Therefore, this project may be used to an advantage by radio clubs through helping to introduce Morse Code and showing the fun of making useful electronic devices with simple resources.

My friend, Kenneth Doolittle W2SMR (dating from the 1934 era of amateur radio), was very amused at my pocket tester when I showed it to him on the way to a hamfest; and he made the appropriate snide remarks on its usefulness. However, during the hamfest he came to me and asked if I could verify that the filament in an antique No. 199 tube was intact. HI! So, you can be assured that you will find good use for this tester if you choose to build one! 73

Bridge Over Troubled Watters

Why buy what you can build?

Peter A. Bergman NØBLX
3517 Estate Dr. SW
Brainerd MN 56401

Test equipment? Build my own test equipment? From scratch? Sure, why not? No, I'm not suggesting you try putting together a four-channel, holographic projection oscilloscope with ten gigs of memory, but there are numerous pieces of test gear that are very handy and easy to build.

For example: If you start with a working flashlight, two lengths of test-lead wire, and a pair of alligator clips or test probes, you could make a continuity tester. And it would still work as a flashlight.

Or, a worn-out three-inch Phillips screwdriver, a 12-volt light bulb, a foot of insulated wire, and an alligator clip can be made into a dingus that is very handy for testing fuses and tracing wires in an automobile.

The RF impedance bridge I'm going to describe here is a bit more sophisticated technically than either of the examples I've given, but still is not all that hard to understand and build. See **Photo A.**

First of all, what can you do with an RF bridge? Depending on the design, one of these can do quite a lot. With this one you can tell if an antenna or other device presents a 50-ohm load to the transmitter at the design frequency.

Why did I decide to build an RF bridge when I already own a very nice, factory-made antenna analyzer? First of all, because of its simplicity, this unit covers a greater frequency range. It is cheap to build and is a very light, compact piece of equipment. Besides, building, especially scratch building, is a gas. I have assembled a lot of kits and really enjoy it, but scratch building is special. And, if someone leaves it on a stump at Field Day, I'll be irritated but I won't be financially destroyed.

This device is based on the Wheatstone bridge, which might not have been mentioned in your ham radio classes. The Wheatstone bridge was developed by S.H. Christy in 1833, but Sir Charles Wheatstone worked out so many applications for it that it now bears his name. Sir Charles was a very prolific nineteenth century scientist who deserves a lot more attention than he has gotten.

If you look at **Fig. 1**, you will see that the Wheatstone bridge consists of two parallel voltage dividers composed of R1/RV and R2/RX. According to Ohm's Law, if the bridge is constructed so that R1 equals R2, there will be zero volts' difference and no current flow between points A and B when the value of RV equals the value of RX, the unknown.

The Wheatstone bridge is capable of measuring resistance to a high degree of accuracy. In the days when telegraph wires connected the country, a

Photo A. Front view of the RF bridge. For scale, KBØYXB is 52 inches tall. Photos by author.

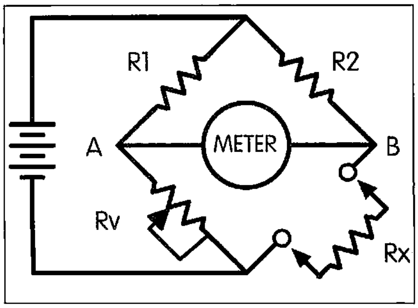


Fig. 1. Basic DC Wheatstone bridge.

break in the line between two stations could be located by measuring the resistance to ground of the broken wire. Since the resistance of a unit length of wire was known, it was easy to calculate which repair crew was closer to the break.

This was great for DC and "pure" resistance, but for radio frequency alternating current and the complex impedances present in antennas, the bridge must be a bit more complex. If we substitute reactance for resistance, ohm for ohm, and AC for DC, the bridge can be brought into balance the same as it could with just resistance. There are many possible combinations and the example here is just one of them.

The design of the RF bridge discussed here is pretty freely based on information from the *Radio Handbook*. More information is available from a multitude of sources under headings including: RF impedance bridge, ratio-arm measurements, Wheatstone bridge, impedance measurements, standing wave ratio measurements, and others.

When a pair of unterminated parallel conductors is connected to a Wheatstone bridge or an ordinary ohmmeter, it will measure infinite resistance and there will be zero current flow. See **Fig. 2a.** Modified to include more complex impedances and fed with RF energy instead of DC, something different occurs when the bridge is connected to the same pair of conductors. At some frequency, the conductors

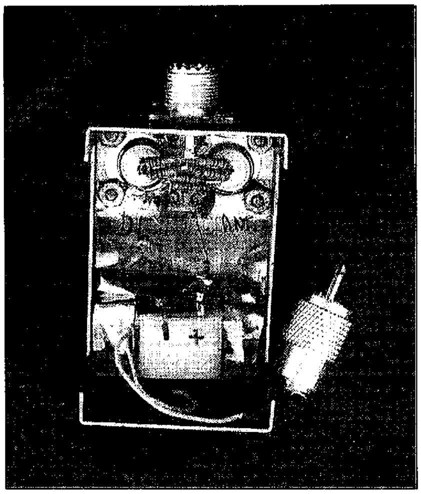


Photo B. *Inside view of the RF bridge.*

will be a quarter wave in length. See **Fig. 2b.** At that resonant point, there will be minimum resistance and maximum current will flow. This short circuit condition could be used to filter out or "trap" an unwanted frequency.

In **Fig. 2c**, the conductors have been separated so that each side is a bit over nineteen inches long and the DC bridge still sees an open circuit. With the AC (RF) bridge, things are a lot different. See **Fig. 2d.** Somewhere in the neighborhood of 146 MHz the spread-out conductors are going to have an impedance of about 50 ohms. The RF bridge will be in balance and the meter will display a minimum or null reading if RV is also 50 ohms. By making the spread-out portion longer or shorter we can move that resonant point, where the 50-ohm impedance occurs, to the desired RF frequency.

The situation changes again when we test closed loops such as quads, or shunt-fed antennas like the J-pole. See **Figs. 2e** and **2f**. The DC bridge will show a short circuit, but the RF bridge will indicate a null at the resonant frequency, telling us that the antenna has an impedance of about 50 ohms to match our rig. I've known cases where individuals built these types of antennas and then refused to use them because their ohmmeter showed the antenna to be a short circuit. If they had used an antenna analyzer like the MFJ-259 or even a simple RF bridge, like the one described here, they would have seen the truth and felt free to connect the antenna to their rig.

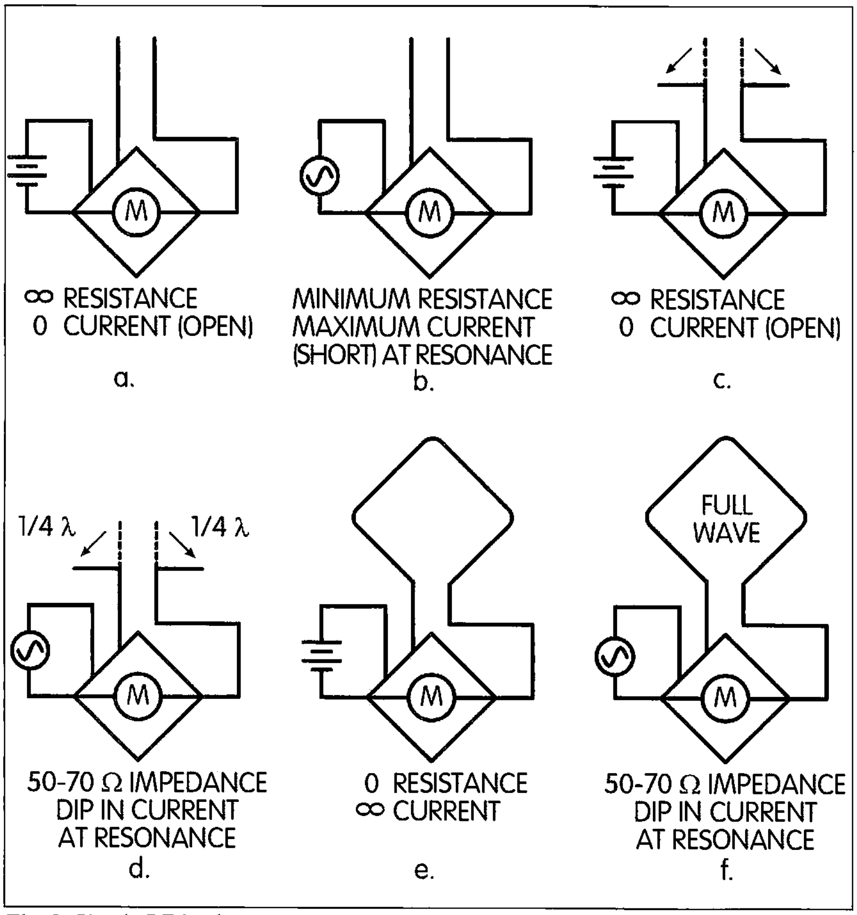


Fig. 2. Simple RF bridge.

Although most of the parts in this project came from my junk box, they are also available from Radio Shack™ and other sources. In my research I found everything at the Shack except a suitable meter. A reasonably sensitive meter of about 100 microamperes is required. I used the S-meter from a junk CB. A dead stereo might also be a good source. Either of these can be found at hamfests, garage sales, and dumpsters. Or, you could contact some of the numerous parts suppliers who advertise in this magazine.

You could dispense with the built-in meter entirely. Instead of the meter, install another female chassis mount connector. An RCA jack would probably do. Then make a shielded cable to reach your multi-meter, assuming it has a 100-microamp scale and an analog movement. That arrangement will not be as portable, but could save a few bucks.

I used SO-239 chassis connectors on this unit and a pair of PL-259s to make the reference loads because I had them and they match most of my gear.

The enclosure I used (**Photo B**) is commercially made, but there are some interesting possibilities on the spice and instant coffee rack. I've used metal Band-Aid™ boxes for small projects like this, but the challenge is similar to building a ship in a bottle. Notice that I lined the inside of the front panel with brass shim stock. Copper might have been better, but I used what I had and it did allow the very short leads I wanted. By bending the brass stock and bringing it almost to the back of the meter, I was able to fold the negative terminal over and solder it directly to ground. The same is true of the R4 and R6/C3 ground points. The only excess lead length is the 3/8 inch between D1/C2 and R5, which does not seem to cause any problems. The two white wires visible in the photo are for meter lighting and are not used in this application.

In **Fig. 3**, resistors R1, R2, and R3, and the two reference (dummy) loads should be matched in value as closely as possible. I was able to produce a matched set of five pairs by starting with 100-ohm 1/4-watt 5% resistors which had actual values ranging from 98+ to 102+ ohms. This proved to be easier than finding five matched 50-ohm resistors. You might prefer using sets of four each, 200-ohm resistors, particularly for the reference loads. Arrange the resistors in ascending order and select one from each extreme to make each pair. It should come out very close. Keep the leads as short as possible to minimize stray inductance. Don't worry too much about the internal stray inductance of the resistors, as it will decrease when they are connected in parallel.

If, after all your care in selecting resistors, the bridge won't quite balance, you will want to install the small variable capacitors indicated by the dotted lines. These are simply small copper tabs soldered to the ground plane and adjusted by bending them near the input/output lines of the bridge.

If you can't find the .0022 µF capacitors, try anything from .001 to about .0047 µF. You should be able to find a pair that will work satisfactorily in the Radio Shack #272-801 assortment pack.

Sensitivity of the bridge decreases as the frequency increases, but this design should still be useful through the 70 cm band. RF input can be provided by a signal generator, QRP rig, or handheld. My unit indicates an open or short at the antenna connector with a full-scale deflection when driven by about two watts in the 80-meter band. In the 440 band, it requires about five or six watts for the same indication.

Since all I'm really looking for is a null reading, I've not tried making a new scale for the meter. I guess I'm not

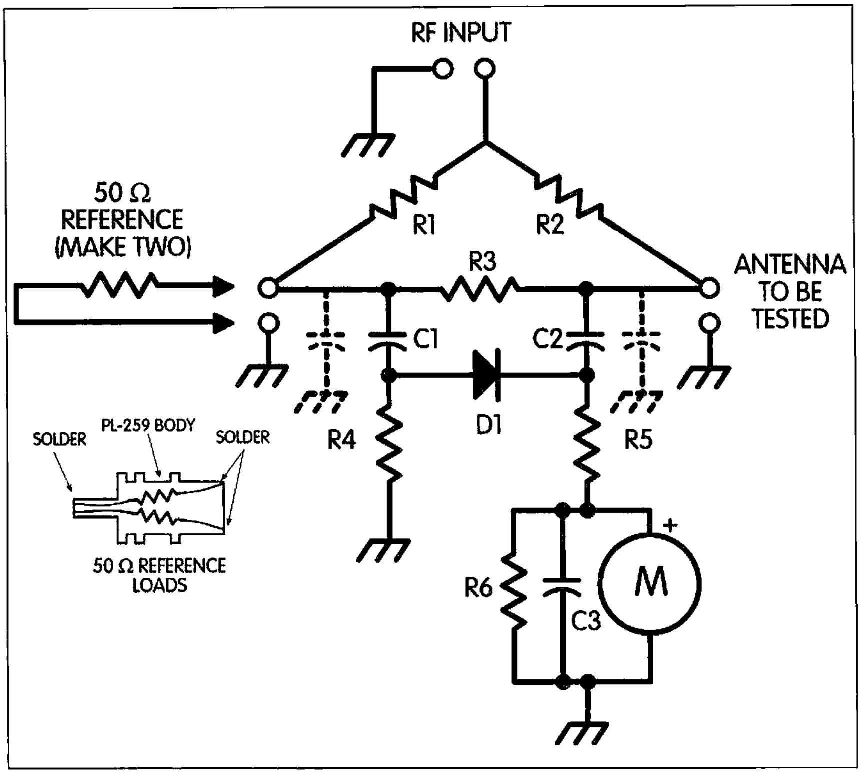


Fig. 3. RF impedance bridge.

very fussy about meter scales on home-brew gear. In fact, I have a home-brew reflectometer on the bench that is calibrated in roentgens. Since no change I might make to the scale would be an improvement in utility or appearance, I've left it alone. Besides, visitors find it amusing I think. Apparently I'm not too fussy about front-panel marking either.

The metalwork in this project could be done with just a hand drill, a couple of bits, and a small assortment of files. Assembly requires only a screwdriver and nutdriver or duckbill pliers. The electronic portion needs only side-cutter and needlenose pliers, a soldering pencil, and rosin core solder.

Test and alignment

1. With both matched reference loads installed, apply a low level of RF to the input.

A. Indication on meter? Install "tab capacitors" and adjust for balanced null.

B. No indication on meter? Increase RF input ... slightly. Still no indication? Go to Step 2.

2. Remove reference load on antenna connector and apply low level RF signal to input.

A. Over 75% scale reading on meter? Go to Step 3.

B. Under 75% scale reading? Increase RF input and go back to Step 2A.

C. No indication on meter? Check RF input. Check solder joints. Check grounds. Check circuit against schematic. Check for open reference load. Check meter. Go back to Step 1.

3. Install reference load on antenna connector and apply same level of RF as in Step 2A.

A. Null? Go to Step 4.

B. Reading on meter? Refine adjustment of tab capacitors to minimize. Go back to Step 3A.

You may not be able to get an absolute zero reading, but it should be very close.

4. Connect an antenna you have been using to the antenna connector and see how it looks. If the antenna is a rubber ducky, be prepared to be appalled.

When performing antenna tests, please remember to keep power levels as low as practical and to identify all transmissions as required.

Do I consider this bridge a replacement for my MFJ-259 Antenna Analyzer? Definitely not! What we've done here is explore some of the theory involved in an instrument like the 259 and tried to show that useful/usable test equipment can be constructed from materials easily found by the home builder.

Have fun, and if you have any ideas about that holographic projection oscilloscope, please let us know. 73, Pete NØBLX.

Suggested reading

Radio Handbook, William I. Orr W6SAI, Editors and Engineers, Indianapolis IN 46268.

The Radio Amateur's Handbook, ARRL, Newington CT 06111.

The ARRL Antenna Book, ARRL, Newington CT 06111.

Parts List

R1, R2, R3	50 – 51 Ω 1/4 W resistors, matched within 1% (RS #271-1108)
Reference Loads (2)	50 – 51 Ω resistors, matched within 1%, mounted in male RF connectors
R4, R5	10 kΩ 1/4 W resistors
R6	100 kΩ 1/4 W resistors
C1, C2	.0022 ceramic disc capacitors (RS #272-801)
C3	.001 μF disc capacitor
D1	1N45 or equivalent Germanium diode
M	100 μA meter
J1, J2, J3	RF connectors to match Reference Loads
Enclosure	Bud #CU-2101B or RS #270-235 (or equivalent)

Table 1. Parts list.

Number 71 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Without a doubt, amateur radio operators have traditionally formed the backbone of communication of this country, and of the world. Whether or not this will continue in this computer age is another story. For sure, the tales some of our cohorts tell ring true in many a shack.

Such was the story told in a letter from W.R. Crockett W3OHF, whose attention was grabbed by our discussion of teleprinter lubrication and maintenance. He writes:

"I worked at the *Voice of America* here in Greenville for about 30 years as a technician, but one of my peripheral duties was Teletype™ maintenance and repair, since we operated a worldwide Teletype schedule with the other relay stations throughout the world—a very busy schedule.

"The organization sent me to Teletype repair school in Chicago sometime in the early seventies. We were trained on the Model 28 ASR and associated units. We later used Model 35s. I have repaired Model 28s in my dreams at times. They were a nightmare of many hundreds of parts. We stocked a huge number of all parts used in the 28s.

"The subject of lubrication was a complicated one. The Teletype Corporation lubricant was very expensive, so we used a number of solutions that were later found to be harmful to humans if inhaled or [acquired] through skin contact. After many efforts, we settled on cleaning them in a large drum containing #2 fuel oil. It left a slight amount of lubricant film but dissolved the hardened grease deposits. Some cleaning solutions would remove grease and oil, but form a slight corrosion if not sprayed with some form of lubrication. We settled on a mixture of Varsol™ with a slight amount of WD-40™. That left a slight amount of oil film on the metal which did not corrode after a short time.

"After the VOA changed from mechanical to electronic RTTY, those units became available for a song on the government surplus lists. Some were obtained by hams, but I don't know why. They require a lot of attention if used very much.

"I dropped the mechanical stuff for ham use and got into solid state with software for my hamming interests. I hope I have recovered some of my former sanity, which suffered severely while I was repairing the mechanical stuff."

I appreciate the perspective, and information on yet another lubrication scheme. As to why hams would snap up old mechanical teleprinters, I, for one, appreciate the sound and feel of an old printer, in a way that keyboards and monitors just can't satisfy. Of course, what good are teleprinters if there is nothing to print? And while there are few things that can beat a good QSO, I commonly receive questions from RTTY fans looking for commercial stations to copy.

This year, you have to check out Klingenfuss Publications' *Super Frequency List* CD-ROM. A leading publisher of books and CDs for professional shortwave radio monitoring for 29 years, Klingenfuss Publications puts out a wide variety of materials of interest to the digital amateur.

As Joerg puts it, the CD-ROM contains 11,100 entries, with the latest schedules of all clandestine, domestic, and international broadcasting services on shortwave, compiled by top expert Michiel Schaay from the Netherlands; 11,800 special frequencies from the international best seller *1998 Guide to Utility Radio Stations;* plus 960 abbreviations and 15,400 formerly

Continued on page 74

Homing In

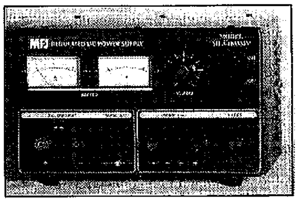
continued from page 63

Leaders needed

As this month's "Homing In" goes to production, the North American ARDF Organizing Task Force is awaiting action from ARRL's Executive Committee on a proposal by the Friendship Amateur Radio Society to sponsor an official IARU Region 2 ARDF Championship in Portland, Oregon, during the summer of 1999. If ARRL approves it and creates the necessary ARDF leadership positions in the US, the next step will be establishing an IARU Region 2 ARDF Working Group, similar to those already in existence for the other two IARU regions.

"Homing In" will keep you informed of progress toward the western hemisphere's participation in this important world radio sport. Meanwhile, you can become an innovator and leader in a new American ham activity. Read up on the principles of ARDF, talk up the sport at your club meetings, train up the promising radio-athletes at your local practice sessions and write up your local foxtailing news. Then send the write-ups to me so we can spread the word in future installments of this column.

New Products



MFJ-4035MV POWER SUPPLY

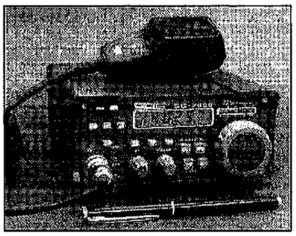
MFJ Enterprises, Inc., is pleased to announce the new MFJ-4035MV 35/30 amp adjustable regulated DC power supply. This new heavy-duty power supply features 35 amps surge and 30 amps continuous, and is adjustable and regulated. Voltage is front-panel adjustable from one to 14 VDC with detent set at 13.8 VDC. The power supply has lighted front panel meters and an ON/OFF switch.

Great features help protect your investment—like the built-in circuit protection that automatically shuts down the power supply when it's drawing too much current, a quiet internal fan that keeps components cool—plus lots more!

The MFJ-4035MV is priced at only $149.95, and of course it carries MFJ's famous *No Matter What*™ one-year limited warranty. For the name of your nearest dealer or to order, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or visit the Web site at [http://www.mfjenterprises.com].

VLF RADIO! THE SOUNDS OF LONGWAVE

Kevin Carey WB2QMY, "Below 500 kHz" Editor for *Monitoring Times*, narrates this 60-minute cassette tape. It lets you hear actual recordings of ships at sea, non-directional beacons, European broadcasters, experimental lowfers, military radioteletype stations, WWVB, 10–14 kHz Omega and natural radio. Some of these signals become more rare by the day, and are preserved here for their historical value. Included with the tape are reference notes, a longwave spectrum chart, and a listener logsheet. *VLF RADIO!* is designed to be an introduction for the newcomer or a reference tool for the seasoned DXer. Tapes will be shipped within 48 hours by First Class mail, for $11.95 (US) each, postpaid, from Kevin Carey, P.O. Box 56, West Bloomfield NY 14585.



USER-FRIENDLY RADIO FROM THE "NO COMPROMISE" GUYS

SGC, Inc., announces the SG-2020 HF Transceiver, designed and built to meet the needs of the experienced and the not-so-experienced radio operator. The simple controls and functionality make the SG-2020 a pleasure to use in the shack, installed in a vehicle, or packing through rough country—the SG-2020 is great wherever space is at a premium.

Features include a 1.8–29.7 MHz frequency range, 0–20 watts PEP transmitter power, 40 simplex or semi-duplex memories, and lots more, at a suggested retail price of $595. Check it all out at SGC's Web site at [http//www.sgcworld.com], then contact your dealer or call (800) 259-7331 for the name of the dealer nearest you.

WORLDWIDE RADIO IN A LITTLE BLACK BOOK ... ER, BOX

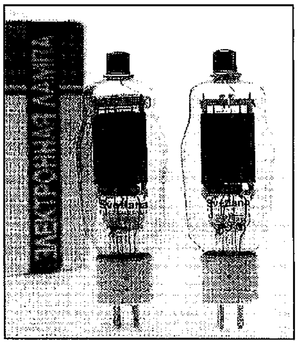
The IC-PCR1000, from ICOM America, Inc., is a "black box" that can transform your computer screen into a high-quality wideband receiver. It connects to computers externally, providing compatibility with many different PC models, even laptops, and offers both band scope functions and exceptional receiver/scanner performance.

It's about the size of a book, yet it puts worldwide reception at your fingertips. Go *beyond* the Internet—the IC-PCR1000 receives local radio and television broadcasts, as well as high frequency/shortwave broadcasts that carry data transmissions, news, music, and events from other countries—enjoy the BBC or an Australian rugby match! You can also scan fire, police, search & rescue, commercial, military, aircraft, and marine communications. With a good antenna, the PCR1000 covers the globe, enabling a computer with Windows® 3.1X or Windows® 95 to become an HF shortwave receiver; worldwide *mobile* reception is a reality, since the PCR1000 may be used in a vehicle by simply connecting to a laptop and using the power from a 12 V cigarette lighter.

Three receiver interface screens, including a communications receiver screen that displays a typical receiver front panel showing S-meter level, frequency readout, and a keypad are great features of the PCR1000, as is the unlimited number of memory channels. And all for a suggested retail price of $599! For more information, and the name of your local dealer, visit ICOM's Web site at [http://www.icomamerica.com].

FREE CATALOG FROM TECHAMERICA

Hobbyists, home-brewers, and electronics professionals can easily order individual electronic components, test equipment, and specialized tools from a catalog designed to serve the needs of small business and individual purchasers. There's no minimum order, shipping is cheap and fast, and credit card orders can be placed 24 hours a day, seven days a week. Get a copy of the latest TechAmerica catalog by calling (800) 877-0072 or visit the Web site at [www.techam.com].



SVETLANA'S 812A TRIODE

Svetlana Electron Devices, Inc., introduces a modern version of the 812A, which was developed in 1939 by RCA. The new medium-μ triode is a companion to (and is identical to) Svetlana's popular high-μ 811A. Both of these power triodes are intended for use in class AB, class B, and class C RF and audio amplifiers, and both feature a low-loss ceramic base and a bonded-ceramic plate cap thermal insulator for high-power RF transmitting tube capability. Svetlana provides an excellent ceramic socket for both types (the Svetlana SK4A), as well as a ceramic plate cap connector, the Svetlana PC1A.

See your dealer or contact Svetlana at: 3000 Alpine Road, Portola Valley CA USA 94028. Call (415) 233-0429 or FAX (415) 233-0439.

Fig. 1. Klingenfuss's CD is the mother lode of frequencies.

RTTY LOOP

continued from page 71

active frequencies—all on one compact disk for PCs with Windows™. Not only can you browse through all that data in milliseconds, but you can search in next to no time—even combined!—for specific frequencies, countries, stations, languages, callsigns, and times as well. It can't get faster than this!

The superb software has been completely revised again, and now features DLL interfaces for Radio Manager (SHOC), RCON (Lowe), and Visual Radio (Liedtke). A powerful concurrent word search facility is included as well. The disk runs under standard Windows and Windows95™. Whether you are an international radio listener, a businessman or a tourist traveling worldwide, a professional monitoring service, or a circumnavigator sailing around the globe, this is the way—just a few keystrokes and you have it all!

Apart from the usual incremental search features, the most powerful tool is the concurrent word search facility (function key F9). Examples: In the broadcast database BC98, entering the words "bbc", "en", and "12:34" takes you, within less than a second, to 39 entries with all BBC frequencies worldwide broadcasting in English at 12:34 UTC. The search word sequence is free: If you enter "23:45", "as", and "en", this gives you 30 entries with all broadcasts in English to Asia at 23:45 UTC.

You can get a look at the contents of the disk, and more, at their Web site: [http://ourworld.compuserve.com/homepages/Klingenfuss/]. There, you can even find current hot frequencies and selected other information from the Klingenfuss archives. Believe me, if you are looking for commercial, military, or other non-amateur RTTY, this is the best way to locate something of interest.

The disk is available directly from them, for DEM60, worldwide surface postage included. You can contact Klingenfuss Publications at Hagenloher Str. 14, D-72070 Tuebingen, Germany. Or E-mail them at [klingenfuss@compuserve.com]. Just make sure to mention "RTTY Loop" when you call, okay?

Once again, we have looked at both sides of radio teletype. The classic mechanical grease monster, and the latest up-to-date computer technology for accessing radio teletype information.

And then, of course, we have the Web. Not the movie—I'm referring to the RTTY Loop home page. Check it out at [http://www2.ari.net/ajr/rtty/] for past articles, links of interest to all of us, and a listing of the RTTY Loop Software Collection, which is always growing. Let me hear from you, via E-mail at the above address or by snail-mail if you must! Next month, even more stuff you all have been asking about, right here in RTTY Loop!

Number 74 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Filters for the amateur microwave bands

This month, I would like to cover filters for our microwave bands by depicting some of the ones I have constructed and comparing them to commercially available amateur-band filters. That's right—I said "commercially manufactured amateur-band." The TTE Filter Corporation of Los Angeles has made available a filter for 1296 MHz that can be used with existing equipment or as part of home-brew transceivers.

Anything that can be utilized at microwave in the pursuit of an improvement in our transceiver's operation is of great importance. One point here that I readily endorse is the construction of home-brew or home-assembled equipment. This filter is one of the key elements in the construction of a radio transverter. The other keys are the preamp, power amplifier, and mixers.

I get great joy out of amateur electronics, or more correctly amateur microwave operations, by constructing my own transceivers and utilizing material that can be found in surplus or be home-contrived. Building transceivers is a very rewarding experience, and I will always prefer it to purchasing an off-the-shelf device—especially since for microwave operation the latter are virtually nonexistent. Don't get me wrong: There are some very nice 1296 MHz transceivers out there, but this is where they end. I haven't seen a manufactured unit for

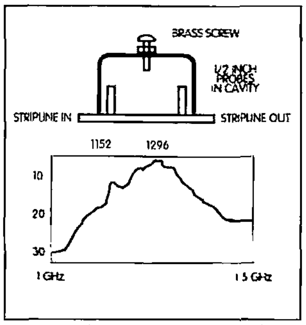


Fig. 1. Copper pipe cap filter for 1296 from standard plumbing fitting. Add a brass screw and two half-inch probes on either side of the center line, tied to PC board stripline traces.

any frequency above 1296 MHz, and that's the prime reason we have to construct our own units.

I have been tempted to go out and purchase off-the-shelf equipment for frequencies above 500 MHz, but have held back the impulse, preferring converters for lower frequency equipment instead. The reasons are many, but they can hinge on component cost and availability.

Part VHF and part microwave, 1296 MHz is a transition band. The material available for component scrounging is a little difficult to obtain without some looking. The oscillator seemed hard to get until we came up with a 1152 MHz synthesizer from surplus material that our group makes available. Add the local oscillator mixer and filter and a suitable amplifier with switching, and you're on the air.

Amplifiers for high power can be obtained from Mitsubishi. With minimal drive, they will put out 10 watts of power. RF preamplifier circuits abound in many books and periodicals, or can be dead-bug constructed on a small piece of PC board and put in a small metal box for shielding. Sounds complicated, but when you think about it a transverter is nothing but a bunch of parts to convey your low-frequency transceiver to a higher frequency for operation. One nice part of that is that all the bells and whistles of your low-frequency transceiver translate to the same operation on the higher frequency. Getting expanded use of your existing transceiver and translation to a higher frequency—now *that's* a high-value service!

Okay—now let's assume we have taken care of the amps, mixers, and oscillators needed for the transverter. What, then, is missing? Well, it's the filters to limit the frequency of operation to a specific required band of operation. The filter should eliminate the local oscillator and the unwanted mixer product. It should have a very good (low) SWR and low insertion loss, and minimum passband ripple. In other words, the passband should be flat.

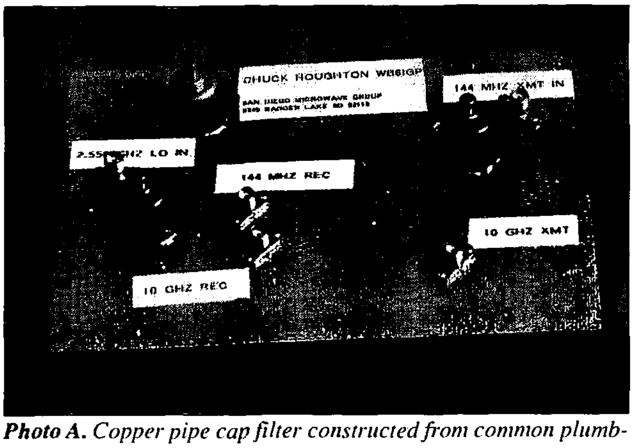


Photo A. Copper pipe cap filter constructed from common plumbing materials. Two internal probes and copper circuit board with 50-ohm striplines and two connectors complete the pipe cap filter. Adjustment is by a brass tuning screw on top of pipe cap in the center, penetrating into the cavity between the two probes from the stripline coupling.

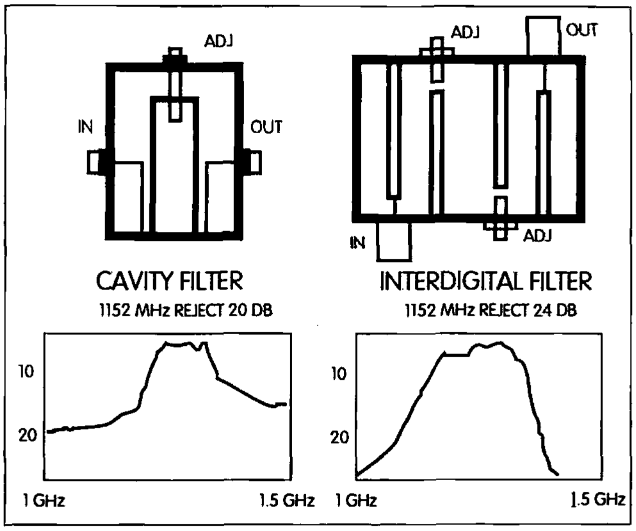


Fig. 2. Cavity filter and interdigital filter for 1296 MHz. The cavity filter and pipe cap filter are quite similar and tuned by one adjusting screw. The interdigital filter has multiple quarter-wavelength elements; each is tuned by an opposing screw.

Let's look into the nuts and bolts of just what a filter can do for us, particularly at the microwave frequencies of interest. Normally, microwave operation is considered to take place from 1000 to 10,000 MHz, but recent equipment has pushed that limit upward. It's not that no one operated above 10 GHz before, but rather that equipment was quite scarce for those frequencies. As a matter of fact, such equipment is quite hard to locate and material usually must be scrounged for almost any frequency above 1000 MHz. This dearth has rekindled a great spirit of homebrew and a desire for self-improved technical expertise—things you don't get from purchasing materials ready to use out of the box.

The shift to microwave for me came about because of my interest in experimentation construction, as well as very enjoyable operation in testing the fruits of my labor. Sure, I had some equipment that was purchased ready-to-go, but constructing a working transceiver and then improving it gave me greater satisfaction than just going out and buying one. Personal satisfaction was at stake here.

Getting to the point of this column, let's take a look at the plus and minus sides of filters and compare them to see what a good filter can do to improve performance. The main function of a filter is to prevent out-of-band mix products from being radiated.

By definition, a filter is supposed to pass wanted frequencies and give attenuation to unwanted ones. For 1296 MHz, the 1152 MHz local oscillator normally used means that a 144 MHz two-meter transceiver can serve as the IF stage receiver/transmitter and still retain all its two-meter features. Mixer

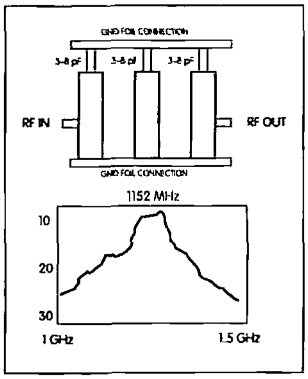


Fig. 3. PC board filter for 1296 MHz constructed from PC board traces and three small-value variable capacitors.

Photo B. *Waveguide below cut-off filter. Constructed from a three-inch section of 10 GHz brass waveguide, two SMA connectors, and a 1 to 5 pF Johanson piston capacitor. The capacitor adjusts the filter to resonance and the SMA connectors' center pins are shorted to the bottom of the waveguide, forming a coupling link inside the waveguide. Very similar in construction to the pipe cap filter except coax connector probes are grounded on the bottom of the waveguide in this filter and capacitor used to resonate instead of copper or brass screw.*

products produced from mixing 1152 MHz and 144 MHz include the desired product 1296 MHz and the very undesirable products of 1152 MHz and 1008 MHz.

Also, the filter must be capable of full-band operation. That is, it must provide minimal attenuation to signals in the 1296 MHz amateur band from the low edge frequency of 1240 MHz to the top of the band at 1300 MHz.

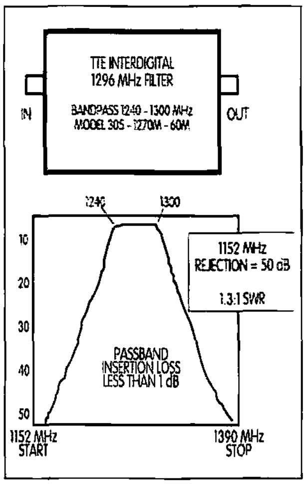


Fig. 4. *TTE filter for 1296 MHz. Bandpass is 1240 MHz to 1300 MHz. Has 50 dB rejection of local oscillator frequency of 1152 MHz and still provides great rejection of signals outside of band edges, with less than 1 dB insertion loss. A great job in engineering such a useful filter!*

Now let's get on with some test results and see what I have to offer on filters as examined on my workbench. The test equipment used was an HP-8620 sweep oscillator and my HP-432 power meter to manually plot frequency response curves of various filters tested. I had made connection from the output of the HP-432 power meter chart recorder output, which provided ample gain and chart drive to plot the differences in passband ripple to a few tenths of a dB. This allowed a basis for comparison among various filters tested.

Not having a custom factory filter for a specific amateur frequency before, I wanted to perform quite a few tests to characterize the filters in detail. In earlier tests, I was quite satisfied modifying existing filters or constructing them and adjusting them for best peaking at a given frequency point of use. As long as I had some rejection to my opposite mix product and the local oscillator frequency, I would use the filter as is. Of course, a better engineered filter could be accomplished, but that always seemed to be a target we could just not hit.

I just kind of ran with what I was able to get after several tries, sometimes even constructing several filters for the same frequency and selecting the one that presented the best results. The wobbly test results were due to my manufacturing construction differences. If your workbench or shop is like mine, metalwork is somewhat difficult to fabricate to exacting dimensions.

The construction of a perfect filter demands exacting pains and dimensional stability to obtain great results. The desired filter should have all of these properties. A flat passband, steep side skirts of high attenuation at other frequencies, and low insertion loss at the passband frequency are some of the very desirable attributes.

The different types of filters I have used at 1296 MHz include a 3/4-inch pipe cap, a stripline-PC board filter, a waveguide below cutoff filter, and the TTE five-pole interdigital filter. All units were designed for use at 1296, with the exception of the PC board filter—which worked at 1152 MHz and compares well.

The lab work

Initially each filter was tested for insertion loss, and then for how much rejection it had at 1152 MHz. This frequency is the common local oscillator frequency used in most transverters working with a two-meter IF (1152 plus 144 MHz equals 1296 MHz). Right off the bat, I could see some very great differences when comparing my filters with the stated performance data on the TTE filter. My home-brew filters' rejection to 1152 was evident, but their side skirts were not very steep and they seemed to roll off in the 20 dB to 30 dB attenuation range.

After making full frequency tests, it was very evident that my home-constructed filters were usable. But the tests also showed that quite a bit of improvement was needed to match the TTE 1296 MHz filter. In all categories the TTE filter showed vastly better performance, with lower insertion loss, flat bandpass over 1240 to 1300 MHz, 50 dB rejection to the local oscillator frequency, and quite steep filter band edges—all the attributes of a very high quality filter. See **Fig. 4** for the TTE filter evaluation. In **Figs. 1, 2,** and **3**, I've included samples of the bandpass curves and drawings for the other associated filters I had constructed previously. As you can see, they roll off and are not nearly equal within the main bandpass area. Additionally, my rejections of the local oscillator at 1152 MHz were not nearly as great as the TTE filter's.

Overall, in comparison I would have to state that the TTE filter is by all means quite an excellent filter. I am sold on its performance. I have made some additional tests using my old HP-851 spectrum analyzer. I looked at the output of each filter in actual operation using my 1296 MHz transverter with its 1152 MHz LO and two-meter IF driver. The TTE filter showed a very marked improvement in operation with regard to conversion loss and rejection to out-of-frequency signals such as the LO and lower mix product of the LO minus the two-meter drive signal. Attenuation (rejection) to these signals was over 20 dB better with the TTE filter and should result in quite an improvement in operation.

With the TTE filter's increased out-of-band rejection, I exposed the transverter to a high-power interfering signal (another signal generator with +10 dB power output) on an out-of-band frequency (1320 MHz) and did not notice any effects to a weak signal being received at 1296 MHz. These out-of-band signals from local commercial transmitters plague both the converters and our IF rigs alike on hilltops. This filter was very effective in reducing problems caused by interfering near-frequency transmitters on the same hilltop on which we are operating our equipment.

When these tests started out, I knew that the filters I had constructed were not top-notch, but were reasonable considering the facilities I had available to construct them and the materials I had at hand.

The overall rating that I can give the TTE filter *is* top-notch. It has solved the problem of a bandpass filter and provided all the attributes that an "ideal filter" should have. I recommend this product to you for incorporation into your 1296 MHz transverter.

Remember, all the components needed to construct any frequency transverter are an amplifier, a mixer, and a filter

Hams with class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Demos by kids

Every year as the end of the fall school term draws near, I look forward to seeing the culmination of months of work as the students demonstrate their projects in ham radio class. The school population at Intermediate School 72 in Staten Island NY is quite diverse. The 6th, 7th, and 8th graders bring in projects ranging from the extremely simple to the more complex. What's important is that all of the 400-plus children participate in demonstrating some kind of creative effort.

I'll describe the ones that were the most popular last year. Perhaps you can pass these ideas along to a teacher, or use them yourself when introducing a youngster to ham radio.

Two 7th graders brought a bicycle to school and spoke about "Testing a Dynamo." They had a large chart which explained that Michael Faraday first generated an electric current in 1831. He moved a magnet in and out of a coil of wire and found that this made an electric current flow through the wire. This discovery led to the invention of the dynamo.

Nowadays we use dynamos to make much of our electricity, and a lot of our present way of life is based on Faraday's discovery. The boys propped up their bicycle so the class could observe their wonderful demonstration. They proceeded to explain that on some bicycles, the lights are powered by a simple dynamo. The movement of the wheels makes a magnet turn around inside a coil of wire. This makes electricity flow in the wire and the lights come on.

They turned the bicycle upside down and balanced it on the handlebars and the seat. They switched on the front light and turned the pedals slowly at first, then quickly. We then asked the class to observe what happens to the light when the dynamo is turned faster. It's a good idea to have the class try to predict the outcome first.

The image of the bicycle on my desk in the classroom stays with the kids and helps them to remember more vividly the concepts we're demonstrating.

I've done the famous "flaming pickle" demo to get the kids' attention many times. Last term, however, the most popular demonstration was the "getting electricity from a lemon" one. I printed up the directions for the project and had a group of the 6th graders demonstrate it for their class.

You make two slits in the skin of a lemon and push a copper

Photo A. Greg (left) and Brian demonstrate a model car they built and "wired up."

to limit off-frequency operation from the conversion of a two-meter transceiver (IF system) to 1296 MHz. The filter is the main item to limit out-of-band products and reject the local oscillator.

Specs for the TTE filter are: Model 305-1270M-60M; passband, 1240 to 1300 MHz; passband insertion loss, 1 dB maximum; passband SWR, 1.25:1; impedance, 50 ohms; dimensions, 1.1" x 1.75" x 4.1"; SMA coax connectors; cost, $200.

I hope you will take advantage of this TTE 1296 MHz filter and TTE's entry into providing an excellent product for the amateur microwave filter market. This area was totally void of any entry prior to their designing this great filter. I wish them success and hope that enough interest in this filter creates a desire to provide additional filters to the market. That's TTE Incorporated, 11652 Olympic Blvd., Los Angeles CA 90064. Tel. (310) 478-8224; E-mail [sls@ttc.com], Web site at [http//www.tte.com].

Well, that's it for this month. Next month I will try to get ready and describe a surplus synthesizer that can be used to generate the 1152 MHz—allowing you to form the basic start for a 1296 MHz transverter of your own.

Photo B. Seventh graders present their doll houses with lighting and burglar alarms.

coin (penny) into one slit and a piece of aluminum into the other slit. Make sure the two metals are not touching each other inside the lemon. If you hold the coin and the aluminum gently against your tongue, you should be able to feel a tingle of electricity.

The current flows because a chemical reaction takes place between the metals and an acid in the lemon juice. The lemon juice acts in the same way as Volta's salt water or the chemical paste in a battery.

I used this fun lemon demo to lead to a discussion about batteries. I assigned a group of four 7th graders to organize and present a "Make Your Own Battery" lesson. Their materials were: two pieces of 12-inch-long wire, cellophane tape, four copper coins, four pieces of aluminum, and a paper towel soaked in salty water.

Here are the directions:

1. Sandwich a piece of the salty paper towel between a penny and a piece of aluminum cut from an aluminum can.
2. Tape the bare end of one wire to the penny.
3. Now make three more sandwiches and stack them all together copper-side-up.
4. Finally, tape the bare end of the other wire to the piece of aluminum on the bottom of the voltaic pile.
5. Now take the free end of each wire and touch both ends lightly to your tongue. You should experience a gentle tingle of electricity.

It is very important to stress to the kids that they will feel only a tiny tingle and that they will not be harmed. Explain that in the voltaic pile, chemical reactions cause a tiny electric current. The current flows from one wire to your tongue and then into the other wire.

After doing a unit on circuits, several students built doll houses, wired up their own lighting, and installed their own circuitry for burglar alarms. The photos of the doll house are all of "alarmed" houses. There were several different techniques used. One is as follows, the equipment being a battery, aluminum foil, cellophane tape or glue, and a small buzzer.

1. Cut a piece of cardboard three inches by six inches and fold it in half.
2. Tape strips of foil around the cardboard.
3. Tape a wire to each piece of foil.
4. Join the wires into a circuit with the battery and the buzzer.
5. Set up the burglar alarm near a door so that anyone coming through the door will tread on the card and set off the buzzer.

Most of the children who did the burglar alarm project built it into a doll house instead of putting it by a real door. But it is a fun project either way.

When all the demonstrations were done, I had students from each class visit my other classes to share their work. I teach 13 different classes a week. The students really gained a lot by listening to each other. Some of the other fun projects that were built were a ballroom with revolving lights from "Beauty and the Beast," a remote-control model car, a traffic light, a robot, several electrical quiz boards, and a variety of static electricity setups.

The important thing was that everyone had a good time and learned lots of good lessons from the whole experience. ■

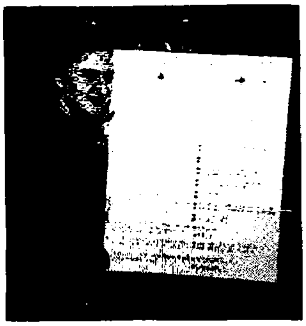
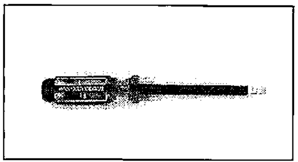


Photo C. Seventh grader Lauren made an electrical quiz board with ham radio questions.

Photo D. These girls from the seventh grade show off their robot with blinking eyes.

Number 79 on your Feedback card

New Products



VRROOM!

Jensen Tools' new HotRod™ safety screwdriver detects the presence of voltage and indicates it with a flashing red LED in the handle. The double-insulated blade provides circuit protection in electrical work; it's voltage-protected for use up to 600 volts and comes with two AAA batteries and a five-year warranty. Find the HotRod in Jensen Tools' latest catalog—get a copy by calling (800) 426-1194 or (602) 968-6231; FAX (800) 366-9662 or (602) 438-1690; visit the Web site at [http://www.jensentools.com].

#1 BEST-SELLING BOOK IN AMATEUR RADIO

Why? Simple—the *1998 ARRL Handbook* is more than 1,200 pages of explanations, information, and practical projects that will help you face the millennium with confidence. The new *Handbook* is the special 75th Edition, a real collector's item—but unlike most collectors' items, it's *useful*. Chances are, you'll turn to the 30-chapter *Handbook* more than to any other reference work—and right now it's specially priced at $32 plus $6 shipping & handling.

Call toll-free 1 (888) 277-5289; FAX (860) 594-0303; E-mail [pubsales@arrl.org]; or write to The American Radio Relay League, 225 Main Street, Newington CT 06111-1494.

MORSE CODE: BREAKING THE BARRIER, BY DAVE FINLEY N1IRZ

This new book from MFJ Publishing is advertised as "The Fastest, Most Effective Path to Code Proficiency" and is for anyone who wants to enjoy using the code on the air—it shows how you can combine modern technology with German psychologist Ludwig Koch's revolutionary (back in 1936) training technique. Using a computer or microprocessor-based pocket code trainer (MFJ-418), you can use Koch's technique to build high-speed code proficiency quickly. According to Finley, Koch's method is very effective because you receive frequent positive reinforcement. You're assured that you are making progress, and thus are less likely to quit out of frustration. There's also a fascinating history of telegraphy.

Order your copy (stock #MFJ-3400) from MFJ Publishing for $14.95 plus shipping by calling (800) 647-1800; FAX them at (601) 323-6551; or check out dealer and ordering information at the Web site: [http://www.mfjenterprises.com].

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Send your stuff to Joyce Sawtelle in the Editorial Department, *73 Magazine*, 70 Route 202 N, Peterborough, NH 03458.

Letters

continued from page 7

of long standing seem to really have developed a connection of some sort between them (not girlfriend/boyfriend, just friends). So, this young lady is currently off for a year in Japan as an exchange student and my son missed chatting with her, but figured he could survive the eight-month absence. Then he got into a real bad teenage romance situation, making him very upset, depressed, etc. After a couple of days of this, he got up one morning and announced that he just had a dream where he was discussing the problem with his friend in Japan and he now felt much better about everything. OK, the imagination is a wondrous thing. But imagine how I felt when he showed me the E-mail he got from Japan that afternoon asking if their "little chat" had helped him get back on track. Then, a couple of days later he had more difficulties with his girlfriend and he got another E-mail from Japan the next day telling him that he had to get himself together since she was in a different time zone and he was keeping her awake! While I can't explain it, I have little doubt of the truth of the story.

It seems like all the published letters say this but I'll add my comment that the main reason I purchase *73* is to read your editorials. They're great! Keep up the good work!

Thanks, John. Sherry and I are constantly reading each other's minds. This seems to be an ability that almost anyone can cultivate, once they get past the idea that it's impossible ... Wayne.

Amazin' Hall Tree Antenna

continued from page 33

record the element lengths, to save time looking for minimum SWR later on.

I have been most pleased with the field strength tests I have performed as well as the operating results obtained on 20 meters. Field strength measurement indicates that the Hall Tree Vertical has a 4.6-dB advantage over my loop, which I have since given away. From a public park in Killarney, Ireland, running battery-powered 10 watts, after several 100% QSOs, I received a 5/7/9 from Novgorod, Russia. I have duplicated the antenna twice and the results have been consistently good.

Sources

Telescoping 38-inch swivel-base whips
Electronic & Parts Outlet
1750 Alma Suite 100
Richardson TX 75081

Ferrite and powdered iron cores
Amidon Associates
P.O. Box 956
Torrance CA 90508

4- x 9- x 48-inch single rifle carrying case
Sporting goods stores
or

Doskocil Mfg. Company
P.O. Box 1246
Arlington TX 76004-1246

Out of Sight, Out of Mind

Discretion is the better part of neighborhood amity. Part 1: strategy.

Kevin Scott WB4BNU
1939 McLennon Court
Lawrenceville GA 30243

Like many hams, I too dream of putting up a few tall towers, one with a few beams to cover my favorite HF bands, another to cover my favorite VHF/UHF bands. But why stop with two? It's only a dream and I am allowed to do that. Now, back to reality ...

My wife prefers to live in a subdivision neighborhood, not out in the country with several acres and an antenna farm. Darn! For now, most new subdivisions have rules prohibiting outdoor ham-style antennas (thank Washington for letting in DSS and local TV antennas; let's keep it up). This, of course, poses a real threat or challenge to the successful operation of my hobby. The choice is mine. I chose the challenge approach, as I want to beat the system with ham ingenuity to show that it can be done.

Unless you live on an unrestricted antenna farm, give up the idea of running 1.5 kW with an extended zepp up one-half wavelength on 160 meters. Maybe you won't have *the* strongest signal during that pileup but you can and will get through—if you have the patience and you put the effort into optimizing the antenna system that you already have. Look at the folks running QRP. For most of you out there, you *can* do it if you plan ahead. I live in an area with restrictions, but there are many ways to make things work for *you!* It mostly takes planning plus a little PR and good luck.

I have seen many articles in several ham magazines over the years devoted to putting up disguised antennas. Some work well, others don't. In most instances they are compromises. I was able to use bits and pieces of each of these articles and come up with a few more ideas of my own to find a solution for me, one with as few compromises as possible. My hope is that you will do the same. One article will not be a cure-all for all people, but I hope to reach a few of you. If I do, then it was worth my time to write this.

"Introduce yourself to your new neighbors and let them get to know you before you tell them about your hobby."

This article will not apply to everyone out there with a desire to transmit on HF, but my goal is to spark some ideas of ways to put together an antenna system that can work. Be creative. Apply what fits, expand on it; throw away the ideas that do not apply at all. First, I will elaborate on what I call my "Commandments" for antenna installations, then I will elaborate on some of the challenges I was able to overcome. Some of these may seem obvious to the old-timers, so be patient. My goal is to spawn ideas for the ham who needs it—regardless of the age of the license!

The Commandments

I. If you have trees, use them! Most anything with some height to get your antenna in the clear will be a bonus.

II. Make friends with your neighbors and educate them about your wonderful hobby. This can be a tricky one depending on where you live and your neighbors' past experiences with other hams, if any. I cannot stress good PR enough. It goes a long way when you help your neighbor fix something with their house—maybe a leaky garden hose, or, especially, something electronic—like hooking up or programming a new VCR. In my case, I get to use their trees as antenna supports.

Continued on page 82

III. Get your antenna in the clear as much as possible and away from the house as well, if you can. This can help alleviate RFI from bugging the XYL (TVI or touch-sensitive lamps turning on and off when you transmit).

IV. What they can't see, they can't complain about. I will go more into this one later.

V. Camouflage, camouflage, camouflage! More on this one later, too.

VI. Put more into your antenna and coax than power amplifiers (more planning, more effort, more money, but don't go overboard). The most important part of a good transmitting and receiving system will always be the antenna. Need I say more?

VII. Plan ahead. Good planning now can mean WAS or DXCC later.

VIII. If at first you don't succeed, keep trying!

Commandment I: If you have trees, use them!

Most areas of the country have trees, but many new subdivisions cut them all down to make way for "progress." Sometimes they replant new trees but these are young and short. If you do not have any trees in your yard or your neighbor's yard or are in an apartment, find another tall support. Look around—you may get lucky! For years, I have successfully used trees as antenna supports. One of my antennas is an insulated (to prevent DC shorts and corrosion) wire that runs to the top of a tree and back down again. It is with this antenna that I worked 35 new states towards my WAS during the 160-meter contest last February, most of these during the first night and most with a 5–9 signal! (I had to start my quest for WAS all over again as I moved quite a bit from my previous QTH.) I will go over this antenna in great detail in Part 2 of this article.

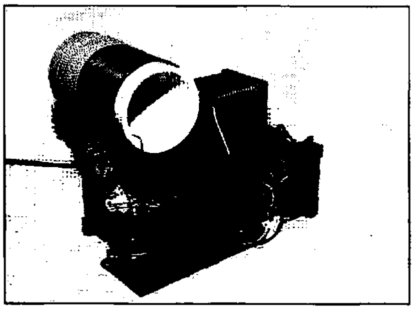


Photo A. *This modified remote tuner is the heart of the author's stealth system (plans in Part 2).*

Commandment II: Make friends with your neighbors.

I can't go far enough with this subject. I have found that if properly approached, most people couldn't care less about your antennas—especially if they can't see them. The antenna size-to-disapproval rating seems to follow an exponential curve, so I won't be pushing for a triband beam anytime soon and I have done fairly well without it. Be sure to introduce yourself to your new neighbors as soon as you can and let them get to know *you* first before you tell them about your hobby. That way they will already know that you are a reasonable person and will not feel so threatened when you ask to use their tree as a wire antenna support. Some of my new neighbors got me a little nervous when I asked them about using one of their trees to be a support for my inverted L antenna and they wanted to see what I was talking about. Once I showed them the wire and what I was planning to do, they couldn't have cared less. A quick prayer beforehand might also have been a help.

Commandment III: Get your antenna in the clear as much as possible.

As has been written many times, the more an antenna is in the clear, the better it will radiate and the more uniform and predictable the radiation pattern will be. Unless you plan on having a tuner as part of your antenna design, keep your antenna away from objects that could cause it to detune during changing weather or other conditions. Nearby metal objects such as gutters should be avoided unless you are tuning it up as an antenna.

I prefer to keep my antennas away from my house for several reasons: It lowers the RF levels at the shack inside the house, reducing TVI, phone interference, touch-sensitive lamp tripping, and even starting the air conditioning system. It lowers the received noise from sources located inside my house. I also prefer not to have an indoor antenna—my ductwork throughout the attic has a metalized jacket and the insulation sheathing of my house is covered with aluminum foil, which acts as an RF shield. If you have no other choices, some antennas in less-than-optimal locations are better than none.

Commandment IV: What they can't see, they can't complain about.

Commandment V: Camouflage, camouflage, camouflage!

These two go together. Be discreet. If you can keep your antenna out of plain sight by using the natural or manmade surroundings of your QTH, do it! As I mentioned earlier, one of my antennas runs up to the top branch of a tall tree in my backyard (mostly) along its trunk and then back down again. The keys to its ambiguity are: the wire gauge is fairly thin (20-gauge, multistranded and insulated; it was zip cord from Radio Shack™ that I split in half) and it was spray-painted with camouflage colors to match that of the tree supporting it. Recently while strolling through the paint section of my local Home Depot™ I found that Krylon® now makes several colors of camouflage paint. They have a flat sheen and come in brown, green, and beige colors. I did the same thing with the inverted L and it blends in very well with the trees.

A note concerning the inverted L: I used larger wire for the horizontal span and smaller wire for the vertical section. I also keep a reasonable amount of slack in the horizontal span section to improve its chances of survival when strong winds cause the trees to sway. When I used thinner wire, I found that it broke on two different occasions. What a pain to restring it!

Back to numbers IV and V—make sure your antenna is not visible from the street. Use your house to block the view; wooden privacy fences help, too. Both of my antennas have tuner boxes mounted at ground level. I have used the aforementioned paint to help them blend in and have planted some bushes to hide them. Other operators have written that they have draped artificial

vines on their antennas to blend them in with the surroundings. Of course, these do not have wire cores. But here's an idea: What if you used the wire core of an artificial vine as a disguised antenna? See? There are *many* ways to get an antenna up in the air without drawing attention.

Commandment VI: Put more into your antenna and coax (money and time) than power amplifiers.

What bands you plan to operate on and what power level you plan to use will determine the *minimum* requirements for your coaxial cable, tuner rating, etc. My longest run is about 100 feet and the bands I will operate from this antenna are 160–40 meters at 100 watts. I stuck with RG-8X because the added cost and size of RG-8 wasn't worth it for me at these low frequencies, and RG-58 was definitely out of the question. The RG-8X was also a nice size for pulling multiple runs through my conduit. If you will be running your coax outside in conduit, make sure that the jacket can sustain extended periods of time under water without breakdown.

Most quality coaxes will meet this requirement. However, if you plan on exposing the coax to direct sunlight, get one with a UV-rated jacket so you will get some life out of it. I used some that was not UV-rated and in six months the jacket had become hard and cracked, letting in moisture to corrode the copper jacket. If you plan to run higher frequencies, look at using a quality grade of RG-8 or RG-213. I will not go into VHF and higher frequencies here, as there are many other things to consider.

Your tuner, if you have one, should be able to properly handle the power output of your transmitter. Make sure that your inductor is as large a gauge as possible to reduce power losses, and that your capacitors have a sufficient voltage rating to handle the power output of your transmitter. If it will be outside, make sure you weatherproof it as well as you can. There are surplus Fiberglas™ boxes that work really well. They are UV-resistant and large enough to fit most tuner needs. The more watertight your enclosure, the less often you will have to replace corroded wires and contacts. For those of you with antennas that require a ground system, I will go into that subject in the next section. A good antenna in a good location with a good match will go a long way. Just ask the QRP aficionados.

Commandment VII: Plan ahead. Good planning now can mean WAS or DXCC later.

If you have an opportunity to put in the required elements for a good antenna system way before you ever plan on completing it, do it. When I moved into my new house, the backyard was grass-seeded and was pretty sparse. My wife and I committed early on to putting down sod since we have dogs and a small child and didn't want to be cleaning dirt and clay off of the floor everyday. Before we put down the sod, I ran two-inch conduit with sprinkler valve boxes (available at home improvement or plumbing stores) in future antenna locations. I also spread out a ground system of eight to 10 pieces of 12-gauge insulated copper wire on top of the dirt. Each radial originated from an area most likely to host a vertical. This was all in place at least a year before I put in the antenna, but at least it was there. It would be a lot more difficult to put this in with the sod already in place.

More on ground systems

For a vertical antenna or any type requiring a ground system, this is the heart of its efficiency. Practically speaking, the more of and the longer the radials, the better. Soil conductivity, proximity to the water table, and salt water if you are lucky, determine how well the ground system will work. A reasonable ground system consists of four to eight quarter-wavelength (for the lowest frequency of operation) radials equally spaced. There would be some improvement in ground efficiency from eight to 16 and a little more from 16 to 32, and so on, but more radials beyond this point will have a diminishing return. For most amateur standards, eight will do just fine. If you do not have the real estate to do this, put out as many as you can as long as you can. You may bend the radials around the corner of your house or lot if necessary. Don't get discouraged if you can't put up an optimal system as you might see in books and articles; install what you can. It is better than no ground at all. Another alternative is to put a screen such as chicken wire or hardware cloth under the base of the antenna. Copper mesh is best if you can afford it or find it. Surface area is very important so keep that in mind. Larger wire is preferred over small wire and copper strips are preferred over wire and so on.

Commandment VIII: If at first you don't succeed, keep trying!

If your first antenna doesn't work well, talk to some other local hams who may have some ideas to improve your situation. There are a lot of commercial antennas out there that tailor to the needs of those with limited space or antenna restrictions. Check them out to see if their performance will meet your needs and your wallet will accommodate their costs. If you have to erect a portable antenna every time you want to operate, find ways to minimize the setup so it is not such a chore. Use a mobile antenna on your car; I don't know of any antenna restrictions on that.

My hope is that you will be able to use some of the ideas presented here to put up an antenna system that will be right for you. In Part 2 of this article I will review an inexpensive multiband antenna system that I put together and am currently using successfully. Remember: Life, liberty, and pursuit of QSOs!

UPDATES

WE DIDN'T HEAR ANY BEEPING ...

Unfortunately, the wiring for the two probes was transposed in the schematic diagrams for the "Beeper Short Circuit Detective" project in the December 1997 "Ham To Ham" column. Here's how the correct wiring should be:

Probe #1: One wire goes to the junction of R4 and R5, the other to IC2, pin 3.

Probe #2: One wire goes to common (shown as the ground symbol), the other to the negative end of C2.

The PCB offered by FAR Circuits is correct with regard to the above probe pads, but capacitor C2 is marked on the board incorrectly. The plus (+) sign on the board should actually be the negative end of C2. This is relevant only to those readers who ordered the FAR Circuits PCB.

SIDETRACKED SATTRACK

In the review of the SatTrack automatic satellite tracking system (page 32, *73*, January 1998) somehow the final paragraph of text wandered off. Reader Ralph Katz KB8ZOY noticed that the address and contact information were missing—and he's absolutely correct: What good is a glowing review if you can't find the manufacturer? This should help:

C&S Engineering
9229 Goldenrod Drive
Fort Wayne IN 46835
Telephone (219) 485-1458.

NEVER SAY DIE

Continued from page 49

the womb and while they were young children? How many Strauss CDs have you in your collection? How about Joplin? And I mean Scott Joplin, not Janis. If you're not sure what to buy in classical music, spend the two bucks for my guide to a 100-CD classical music collection.

From Inside Arabia

A letter from AB4Y, who is working in Saudi Arabia, got me to thinking about the repercussions of the development of cold fusion. Our small towns will be enhanced by the loss of all those corner gas stations, but what will happen to the OPEC countries? My correspondent says that when the demand for oil vanishes the Saudis will go back to the 6th century. The Saudis have no literature, no skills, no infrastructure, nothing that will allow their country to exist. Saudis have no work ethic, no conception of learning, no appreciation for the value of education—especially technical and engineering education—no concept of the non-Muslim world, no ambition, no drive, no concept of excellence. Without the oil the country would go back to people living in tents in the desert.

Their technical work is done by Pakistanis, Muslim Indians, and Filipinos. Grunt labor is done by Sri Lankans, Bangladeshis, and Yemenis. Chuck's company brought in 130 Sri Lankans to clean up the airport.

He says the toilets are filthy. They were designed with toilet paper holders, but they don't use paper. Instead, they have a hole in the floor with places for your feet as you squat and a hose to wash yourself off afterward. The Saudi version of the bidet. There's no soap or paper towels in the public toilets (hmm, that's like many of ours).

In Arabia, Israel is a non-country. Books and magazines have the word "Israel" blacked out. It's blacked out on wall maps. Also, any depiction of the female body is blacked out. The government has hundreds of Bengalis to put India ink on any photo that might be objectionable. Even articles and drawings in the *Reader's Digest* are cut out or blacked out. All pictures of men and women kissing, and any references to alcohol, including beer, are blacked out.

All incoming packages are inspected, and using the Internet is forbidden. Satellite dish users must subscribe only to approved channels. Well, you get the idea.

The advent of a new energy source such as cold fusion will be catastrophic to most of the Arab oil countries, who have been living a life of ease on oil money.

College

My father was just the right age when World War I came along, so he went to military school and then into the Army, where he opted for the Army Air Force. He always felt inferior about having missed college, so there never was any question during my school years about my going on to college. Which I dutifully did.

Fortunately, in a way, World War II came along and sucked me into the Navy after two years at Rensselaer Polytechnic Institute. Well, being a New Hampshire boy, I'd planned on going to Dartmouth, but my being a ham and up to here in building electronic equipment convinced my high school advisors that I really should go for electrical engineering. So I did. Big mistake.

The Navy electronic school was superb. I loved it! Then, four years later, after the War, I went back to RPI to finish up. Unfortunately, by then I'd started to wise up. Oh, I enjoyed being president of the Radio Club, singing in the Glee Club, being the sound man for The Players, and working the world from my super ham station in the basement of our fraternity house (Sigma Chi). We were riding high, with our president being elected the Grand Marshall of the school, and our winning both the interfraternity scholarship and sports cups. Plus we lived in the old governor's mansion in the posh part of town. That was nice because I had lots of room to hang wire antennas.

But the college was lousy. Beautiful campus, bum curriculum, plus terrible teachers.

The professors were busy doing research and had little time for teaching, so we had to make do with graduate students as teachers. If you bother to read any of the education magazines or books, you know that this situation has gotten infinitely worse since my days in college.

Thirty years ago, professors averaged 12–15 hours a week teaching. Now it's six hours or less a week. That means it's taking two or three times as many professors to teach. So, if you have any question as to why college costs have been rising far faster than inflation, just remember that teacher salaries have been way ahead of inflation for years, and we need twice as many.

So what are all these professors researching? You don't want to know. Their aim is to earn tenure, and that means being published. So one professor is doing a study of wood rats to try and see why they are leaving Pennsylvania. 99.44% of the research papers are published and disappear into college libraries, never to be seen (or needed) again. But that's the system, and the only people who really suffer are the students, who have to help pay for all this foolishness. Well, actually, mostly it's their parents who are paying the bills.

As I've griped before, the usual college graduate has managed to forget around 95% of what was "learned" by cap and gown time. Fortunately, 99% of the stuff crammed into their heads for test passing has little relevance to their later business, family, or social lives, so it doesn't matter that it's forgotten.

Those research projects cost a lot more than the professor's time. There's often travel, laboratory equipment, and research assistants. Then there's the art of grant proposal writing, which is

a whole industry in itself. But then grants are a multi-billion-dollar industry, and one way or another we're footing the bill for this nonsense.

Well, gee, look at some of the amazing developments that have come from the system—like the transistor. Well, um, maybe. There's powerful evidence now that many of our more remarkable discoveries resulted from the infusion of alien technology recovered from crashed UFOs. Col. Corso was the man at the Pentagon who helped researchers develop transistors, ICs, lasers, night vision, and other breakthroughs. Read his book, *The Day After Roswell*, for the full story. It's been a best seller, and no one has yet come forward to challenge his story. Several people with excellent credentials have confirmed it.

If you've been reading much you've seen some of the silly research projects that have been funded. You know, like Professor Jane Dirks of Carlow College, who did a study of the ethnic backgrounds of people she met while walking her dog. Her paper was presented at a meeting of the American Anthropological Association. Darn, the wonderful things we've been missing!

Ron Brown

I've been listening to the Art Bell radio talk show and you haven't—otherwise you'd know about the bullet hole that was found in Secretary Ron Brown's head when his body was brought back from the airplane "accident" in Croatia. Investigative reporter Chris Rudy had both an interesting story and the evidence to back it up.

You probably remember the reporting on the so-called accident, where the plane with Ron Brown and a group of American businessmen crashed, killing everyone aboard. The first reports were that bad weather was involved. Later, it was admitted that the weather was just fine. Then they said there was a problem with a missing or misplaced radio navigation signal which had led the plane astray. Unfortunately the man who they claimed had moved the transmitter was found as an apparent suicide.

The doctor who examined Brown's body when it was brought back to the US reported a hole in the middle of his forehead. X-rays showed the fragments of a bullet inside the head. Rudy took photos of the body and the x-rays, which were posted on the Art Bell Web site (www.artbell.com). Later, another x-ray was made, with the x-ray out of focus enough so the bullet fragments didn't show. Now I know you're not going to believe this, but nothing whatever was mentioned of the bullet hole in the final medical report, and all of the x-rays have disappeared.

The "accident" put an end to a lot of embarrassing stuff that was expected to come from a pending official investigation of Ron Brown's affairs which was predicted to result in the indictment of several high government officials.

I realize that Bell's show is on in the wee hours, but he has interesting enough guests to make it worthwhile to record his show and listen to it at your convenience. Yes, he's on in your area—you just have to tune around the AM radio band some night and find which station brings it in best. He's on from 10 p.m. until 3 a.m. Pacific time five nights a week. I get him best on 1210 WPHT (Philly), 770 WABC (NYC), and 1100 WTAM (Cleveland). I use my VCR to tape the show.

The Rat Race

If you are not a rat, why are you stuck in the rat race?

Okay, what do I mean by the rat race? Fair enough question. Let me try to quantify it. You're participating in the rat race if you:

1. Have been working for someone else for more than a year or two.
2. Went to a public school.
3. Went to college.
4. Aren't making enough money and don't have the freedom to travel when you want to.
5. Have a chronic illness.
6. Are addicted to alcohol, caffeine, or nicotine.
7. Are living in a major city.

Well, you get the picture, and the odds are that you are in the rat race, complete with the usual stresses. Hey, I worked for others for several years. I went to public school. I went to college, and I lived in New York City for 30 years, on and off, so I know the rat race personally. And the resulting stresses.

But, as soon as it was even remotely practical, I moved from New York to New Hampshire. And by the time I was 40 I'd visited over 50 countries. If it hadn't been for WWII, which took four very valuable years out of my life, I might have progressed earlier.

Of course, I didn't know any better than to go with the flow (floe?), so I sucked in, along with everyone else, on the group-think acceptance of the usual life track. There were no books or magazine articles suggesting that there might be some alternatives. In the 1960s millions of kids opted to drop out of the system. Their alternative, a version of socialism, failed, just as socialistic approaches have failed everywhere they've been tried.

Just because our public schools suck and are getting suckier; just because our colleges ditto; just because our medical industry is screwing the hell out of us; just because our politicians are ditto; just because our legal and prison system are ridiculously expensive and are failing to do their job; just because most of us are stuck working for a jerk, and with little in prospect in the long run—is no reason to stay mired in the depths of a rut when making some changes in your habits and thinking could let you thumb your nose at the crap everyone else has to live with.

Free Will

I've been thinking again, which is never a good sign for readers who are monomaniacal about amateur radio. How much can you think about amateur radio, anyway? The short, dry editorials in the other ham rags answer that question. Also, our betters at the League have decreed that we should not discuss politics or religion over the air—and by extension, this would hold for the ham magazines. Only the free-thinking or the rebellious dare challenge the ARRL dictates (made for our own good, of course). Fortunately these weirdos are in the minority.

That written, let's consider the concept of free will. How much free will do we have in life? Those of you who've done your homework and watched the movie *7-14-21-28-35* have graphically seen how firmly established are the patterns of a whole lifetime by the time a child is seven years old.

The documentary interviewed a bunch of kids when they were seven, then 14, 21, and so on. While it did demonstrate how little we change after childhood, it didn't go into the things that had formed their characters so solidly by the time they were seven. The influences of the parents and extended family, of treatment during the prenatal period, the birthing process, day care, and so on. These are the experiences upon which a lifetime of living are built and habit patterns formed which are virtually unbreakable.

If you smoke or are fat, you know how powerful habits can be. Alcoholics and other drug addicts know, too. And it's these same destructive habits which keep us from changing our eating, working and behavioral patterns. You know by now that changing your diet to one mostly of raw fruit and vegetables and stopping your input of poisons will help clear up most of your chronic illnesses and extend your life substantially. But that doesn't get you to pass up McDonald's™, Dunkin Donuts™ or KFC™. It doesn't stop your drinking coffee or eating Danish. Or fries with your Whopper™.

Which brings up the question—since these lifestyle patterns (habits) are learned early, they're the result of the early training of your parents and

teachers—so how much freedom of will do we actually have?

We tend to equate complexity with randomness. That's why chaos theory so surprised scientists. There turned out to be some sort of order to what we'd perceived as randomness. Hmm. Which brings up the question of whether there is any randomness at all? Is the future solidly written in the patterns of the past and present?

One of the big problems computer scientists faced was what seemed like a simple matter: designing a random number generator. It was needed for shuffling cards and rolling dice by game designers. It turned out to be a major problem. Computers, like Mr. Spock, are totally logical, so there is no randomness anywhere in their workings. The programmers "solved" this problem by designing pseudo-random generators.

By extension, if the complexity of the cause and effect of weather patterns could be coped with, we would see that there is *no* randomness involved. Yes, we'd have to be able to take into consideration the flight of a butterfly and how the movement of air caused by its wings will affect the weather a thousand miles away. That's complex beyond our brains or computers, but is there any randomness really involved?

Viewed from that perspective, the universe, our galaxy, our solar system, our planet, and your life are all the inevitable product of an enormously complex system. Complex? You bet! Random?

I'm reminded of the fatalistic beliefs of the Egyptians when my father visited Egypt in 1938, while setting up bases for the first trans-Atlantic airline, American Export Airlines. When driving through Muslim countries he had to beat on the door of his car to get pedestrians to move out of the way. Their belief that they would die when their time had come was so strong that they refused to get out of the way of cars. They were not going to die until their time had come, and when it did, nothing could prevent it.

American Export Lines was America's leading steamship line and their major tourist route was around the Mediterranean Sea, so that's where they wanted their airline to go, too. My father spent a year organizing seaplane bases for the airline in places like Barcelona, Genoa, Beirut, and Alexandria. There were few international airports in those days, so flying boats were the only practical way to fly. Then came WWII, with the Navy taking over control. The airline ran all through the war under my dad's direction, going the southern route during the winter via Belem to Dakar and up to London. In the summer they flew via Gander, Newfoundland, to Iceland and London.

Just before the end of the war President Roosevelt, who was a good friend of Juan Trippe, the president of Pan-American, issued a Presidential Order saying that no steamship line could own an airline. This ended with Pan-American taking over American Export Airlines. How much in political "donations" did that order cost Pan-American?

Ooops, as usual I have digressed.

Knowing that being overweight is going to make you sick and shorten your life, do you have the free will to change your diet and to stop poisoning your body? Can you stop smoking, drinking beer and coffee? Will you invest $180 in a Genesis™ still from Damark and stop poisoning your body with fluorides, chlorine and all the other toxic crap your water supply is providing? Like the Arabs, will you refuse to get out of the way of the onrushing truck (figuratively)? By the time you have emphysema, a heart attack or a stroke, the moving finger will have writ. But it's *your* finger that has done the writing, not Mother Nature or God. Or Satan. Unless you are a total prisoner of your habits (which includes procrastination) you can opt for Alzheimer's and being tied to a chair in a nursing home or for being out there skiing the slopes of Aspen with me. I think you *do* have a choice.

Gold Mine

If you know of any lawyers who might be interested in making some really big bucks, there's a golden opportunity for them just waiting. For once the lawyers in England are way ahead of our American counterparts. They, with the help of the government, have instituted class action suits against Colgate™ for the damage the fluorides in their toothpaste have done in permanently discoloring children's teeth. It's called dental fluorosis and is a discoloring and mottling of the teeth caused by fluorides in the drinking water and in fluoride-laced products, such as toothpaste.

In the first case Colgate settled out of court for nearly $2,000 to a 10-year-old child.

In the US it is estimated that around 30% of the children in nonfluoridated water areas suffer from some degree of fluorosis and around 80% of the children are affected in areas where the water is fluoridated.

In addition to municipalities adding fluorides to their water and toothpaste companies adding fluorides, also liable would be dentists and pediatricians who daub fluorides on their patients' teeth or prescribe fluoride supplements. Bonanza!

Liable, also, would be newspapers and magazines endorsing the use of fluoride supplements or water fluoridation, media advertising fluoridated products, the manufacturers of the products, and their advertising agencies.

While there are some products which might not, by themselves, result in dental fluorosis (mottling), their products do contribute to the problem and could be named as co-defendants, providing some very deep pockets to pick for enterprising lawyers.

Dental fluorosis has been a well known result of fluoride exposure for many years, so the firms and groups providing these products have no excuse that "they didn't know" about it. Thus, they have the responsibility to warn customers of possible injury from their products.

If you have been brainwashed by the media and the ADA on the benefits of fluoridated water it's time to do some homework and dirty up your mind with some data. If you'll read *Fluoride, The Aging Factor*, by Dr. Yiamouyiannis (#4162 from Acres USA, $15), which I've recommended in my past editorials (please stop griping about my being repetitious—I'll stop when you stop ignoring what I'm telling you), you find that there are no known benefits to the drinkers of fluoridated water and plenty of dangers. The book is also reviewed in my $5 *Guide to Books You're Crazy if You Don't Read*. The truth is that a high percentage of us in America are being slowly poisoned and it's shortening our lives. Fluorides increase the risk of heart disease, cancer, allergies, and even brain damage.

If fluoridation is so great, why have 12 Nobel Prize winners termed it worthless? And why have Austria, Egypt, France, Germany, Greece, Holland, India, Italy, Norway, Spain, Sweden and other countries either never accepted or else stopped fluoridation?

The worthlessness of fluorides in the water as far as preventing tooth decay in children goes has been proven in double-blind tests. What hasn't yet been documented is what it is doing in the way of birth defects, which can be subtle. Mothers who don't distill their water before drinking it are taking one heck of a gamble with the lives of their children.

These chemicals are big business and generate millions of dollars for the producers.

Oh, yes, have you looked at the fine print on any of the fluoride-laced toothpastes recently? Since April of 1997 they've all had to have a poison warning on them.

No, I'm not going to get into an argument over whether brain damage makes a person more likely to become a ham. You listen to 14,313 for a while and make up your own mind.

PROPAGATION

Hoo, boy! I'm not sure if I should tell you to put on your boots, snowshoes, or windbreakers! The "conditions" between the 10th and 12th, and again between the 21st and 23rd, could be awesome from the standpoint of weather and other geophysical effects, as well as propagation. There may be greatly increased solar activity on or about the 11th and again around the 22nd which could shut down the HF bands, then bring them to life! Within a few days after a "blackout," the bands usually recover from excessive ionization. You may discover superb DX propagation for a week after the 26th, but probably not between the 12th and 15th.

On the days surrounding poor or very poor HF activity, VHFers should pay close attention to the bands and expect some unusually interesting DX, particularly on six and two meters.

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

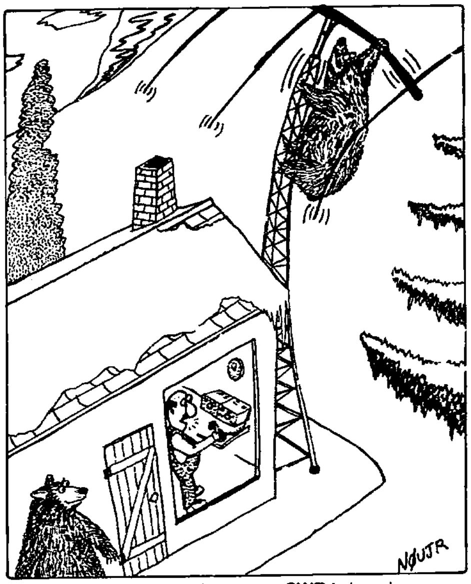
DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the US.

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar). Short-skip during darkness to 1,500 miles or more.

This band ought to begin to come alive during the hours of darkness when QRN permits. Try the days marked G on the calendar for best results. DX toward the east until midnight, and to other areas afterwards until dawn. Short-skip to 1,500 miles will prevail when the band is quiet. 73, W1XU.



"Hang on a minute Larry...my SWR is jumping...
I'm going outside and see what the problem is..."

MARCH 1998

SUN	MON	TUE	WED	THU	FRI	SAT
1 G	2 G-F	3 F	4 F	5 F	6 F	7 F
8 F	9 F-P	10 P-VP	11 VP-P	12 P-F	13 F	14 F
15 F-G	16 G	17 G	18 G-F	19 F	20 F-P	21 P-VP
22 VP	23 P	24 P-F	25 F-G	26 G	27 G	28 G
29 G	30 G	31 G				

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA									15	15	15	
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

Including Ham Radio Fun!

73 Amateur Radio Today

APRIL 1998
ISSUE #451
USA $3.95
CANADA $4.95
International Edition

Ramsey FX-146 Mods

De-Noising Your PC

Home-Brew 2m Antenna

Reviews: Hamtronics' $50 Converter Kit!

Quickie All-Band Stealth Antenna

Controller for Fox Hunting

04
0 74851 08725 1

Number 1 on your Feedback card

Never say die

Wayne Green W2NSD/1

Depressing, Isn't It?

Depression is difficult to tackle because there are several potential contributing factors. #1 is psychological, where a person is faced with a seemingly insoluble problem and just gives up. #2 is also psychological, the result of childhood abuse. This is similar to #1, in that the child suffering the abuse is unable to cope with it and gives up. Unfortunately this lingers on as teenage depression and, according to a study at UNH, correlates with teenage suicide. #3 has to do with both lousy nutrition and the possible allergic sensitivity to something being eaten or in the environment.

I was depressed a good deal during my teens and 20s as a result of childhood beatings by my father. This is now called child abuse. My life was totally changed when I was 28 and discovered a super-fast and highly effective psychotherapy. It did in hours what few psychiatrists even hoped to do in years. I got very good at using this approach, but I gave it up when I found that very few people really wanted to improve their lives.

Allergies can exacerbate depression. I've got a couple of good books on that subject around here somewhere.

If our bodies are getting the nutrition they need — including the minerals missing in our supermarket food, and we're drinking distilled water instead of city-provided sludge, we're exposed to actual sunlight, breathe fresh unpolluted air, and avoid the usual

sugar, white flour, dental amalgam, root canal teeth, fluorides, hydrogenated fats, etc., and we get plenty of exercise, then depression is highly unlikely. Hey, some music won't hurt, either. A two-mile brisk walk in the sun every day, exercising with hand/wrist weights, rolling the eyes instead of just looking straight ahead, hyperventilating and breathing totally in and out of the lungs will do a lot to get rid of depression.

People who prefer to live in the city, where the air is polluted, and eat Danish and coffee for breakfast, are going to have to recognize that this is going to cut their normal life span about in half. A short life, but a merry one, right? Merrier than living out in the country on a small farm, where the air is pure, the sunlight unfiltered by smog, where you can run your own small mail-order business and fit in an hour's walk every day? Where the EMFs are minimal, the neighbors a half mile or so away, and you can grow your own food, complete with the minerals missing from the supermarket stuff. Sure, give me the city, with its grime, smog, crime, drugs, $20-a-day parking, $500 apartment rentals, and so on every time. Oh, I almost forgot the rudeness of your neighbors, the stress and constant aggravation.

As I write this I'm looking out of the window at nine damned deer eating my hedge. Go away! And then I chuckle as I read pathetic letters from hams living in houses or even towns with an-

But all that doesn't have much to do with depression. When you're depressed you don't have the initiative to get out of the mess you're in, so it just gets worse. It takes a lot of initiative to work out the details of how to move yourself and your family from an apartment in Brooklyn or San Francisco to a farm in New Hampshire or Oregon, two or three hundred miles and a lifetime away.

Thus, step number one in fighting depression is to tackle the easy parts: nutrition and exercise. A switch to raw foods, with mineral and vitamin supplements, plus a daily brisk walk or jog for a couple of miles and a few minutes listening to good music should get you out of your funk enough to start planning a better life for you and your family. How about that big antenna farm you can have, eh? And maybe some chickens running around your yard. I've got a couple chickens, a duck, a turkey and three rabbits running around mine. And that doesn't count the wild turkeys and pheasants in the fields where I walk.

Exposed

A reader whose expertise is hospital electronic equipment explained that one of the hospital regulations requires the use of special wall outlets for safety grounding reasons. Besides being a bonanza for the only firm making 'em, there's a rule that they have to be tested regularly. Most hospitals have two men whose jobs are

the reports. But, since nothing goes wrong with the outlets the men spend 40 hours a week falsifying their reports. The cost of maintaining these special outlets per year, not counting the paid maintenance men doing the tests, costs an average of $50,000 a year per hospital.

All of which may help to explain why hospitals cost so much when you need 'em.

Of course, if you pay attention to my recommendations, you're not likely to need a hospital unless you suffer an accident.

The Begging Bowl

I got a form letter recently from Ambassador Petrone, who lives in the next town over. He was asking me to donate money to the Republican party. For a couple of thousand bucks I could become a NH GOP Club member. Wow! It reminded me of the endless letters I got from presidents Reagan and Bush asking for donations. Anyway, here's what I wrote the good ambassador. No, I didn't get any reply.

Why did the Republicans lose the last governor's race? Was it money? Was it a lack of good management of the campaign? Was it a weak candidate? Was it a serious lack of a stated program for achieving the Republican goals? For that matter, are there any actual specific stated Republican goals, or are they amorphous … less government, less taxes? I haven't seen any plans for achieving that mentioned anywhere.

And, by the way, where does donated money go? For generous salaries? For whom? Is there any accounting to us Republicans of the revenues and expenses of the NH Republican party? How can I find out about this? My suspicion is that there is a crisis of leadership in NH that more money is only going to make worse, just as government spending has made virtually every other social problem we face worse.

Politicians can only be stopped in their spending by

credit, as ex-Governor Gregg once explained ... and as we've seen proven endlessly. And since the NH Republican party is run by politicians, is there any reason to believe that our party leaders are working with a different agenda?

We *do* have some serious problems: really bad schools, a corrupt health care industry, a corrupt Congress, a corrupt Administration, a judiciary that ignores the Constitution in its social engineering efforts, a mineral- and vitamin-deficient food supply, endless poisoning of our people — sanctioned by the government, a drug war that's totally failed, a war on poverty that has failed, and so on. There are some fairly simple solutions to all of the above, but you'd never know it from listening to our politicians, Republican *or* Democrat.

You mentioned people will pitch in if there is "direction and leadership." Is there any? I know I've seen no signs of any.

Permission is granted to use my letter format as an answer every time a politician rattles his begging bowl. Just input it in your computer and print out a copy when you need it.

QCWA

When the QCWA endorsed the continuation of the code test as the major barrier to a ham license, I wrote the following letter. I'll bet you won't believe that they didn't publish it. Or even answer.

Barry: The latest issue of the *QCWA Journal* arrived — nice job. And I know how much work it takes to put out a magazine. But, you know, I didn't see any invitation for letters or comments. I respect that the ARRL has made it abundantly clear that the QCWA being active in amateur politics is not an option. Ask past-president Harry Gartsman W6ATC about what happened when the club timidly ventured into that arena.

I was delighted to read that the club officers are 100% in support of the code test. I couldn't agree more. 1000%! The only small complaint I have is that the entry (Novice) test should be raised to at least 20 wpm. This will help keep the riff-raff, CBers, and nuisance kids out of our fraternity.

When I joined a high school fraternity I underwent hazing. They forced me to chew lye soap and then drink Coke®. I'd never before tasted Coke, but despite the intense pain it inflicted on my raw and bleeding mouth, I've drunk dozens of bottles and a couple of cans in the ensuing 60 years. Hazing is an institutional ritual when joining a fraternity.

In college the hazing was even more rigorous (and painful) when I joined Sigma Chi. In addition to endless vigorous paddling, we pledges were put through a series of tried and tested rituals. Like when I was driven miles and then dumped on a deserted country road at midnight in a snowstorm and left to find my way back. Serendipity stepped in (Allah be praised!) and W2MAM came along minutes later, on his way to dump some of his pledges (from a different fraternity, just a few doors down from ours) in the middle of nowhere. So I got back before my fraternity brothers. Yes, of course I was punished! I also was given five minutes to learn the Greek alphabet — which I still remember. It comes in handy every now and then, doing crossword puzzles.

So, fraternity hazing is acceptable as long as too many pledges don't get killed. And in the ham fraternity our major hazing instrument is the code. No, it serves no useful purpose any more, other than as a means for old-timers to have fun. But that's what ham radio is all about these days, right? Our ability (and the need) to provide skilled technicians and operators for the military is long gone. Our public service days are winding down, supplanted by cellular telephones. It's been decades since we contributed technically to the art. These days we are an elite group of aging survivors, doing our best to get all of the recognition we can from our group via contests such as DXCC, and we've done almost nothing to encourage newcomers in the last 30 years.

So, if we're going to keep down the HF QRM, the QCWA officers are 100% on target. Stick to the hazing. Force newcomers to take the time and do the hard work it takes to build a skill that for them seems almost completely useless and will soon be lost, making the whole thing an enormous waste of time and effort. With over 90% of what few active HF hams we have left on voice, I can understand their complaint. Heck, let's make it even more painful with a 20 wpm minimum. And make that retroactive, requiring Extra Class licensees to requalify when they renew their tickets. If the QCWA officers honestly believe what they're saying about the code being important, then they should support this simple change.

Those FCC Auctions

Once Congress got the smell of money, the lid was off as far as auctioning off parts of the radio spectrum was concerned. From the Congressional point of view, it's been an $11 billion bonanza. Whee! More money to spend! And that (it may come as a news flash to you) is the primary interest of Congress. The control of money is power.

Auctioning off spectrum to the highest bidders has its downsides. For one, it guarantees that the biggest corporations are almost certainly going to be the big winners. It takes deep pockets to come up with $11 billion. For two, this means that it is unlikely that we, the public, are going to get the latest, greatest technology.

Continued on page 80

LETTERS

From the Ham Shack

Kenneth E. Stone W7GFH. Some months ago I got interested in Thomas Miller's Bioelectrifier, reprinted in the May 1997 issue of *73*. His statement that one should not use a 555, etc., which would result in complicated circuitry, voltage regulation, and high current, was an immediate challenge. Further, I wanted to build it with only materials on hand (no optocouplers). The result was a simpler circuit using a 555 oscillator with two transistors doing the current reversing and a third transistor as a phase inverter, since the 555 has only a single output. That circuit uses about one third the current of any of Miller's circuits. The duty cycle had a 5% unbalance, which appeared to be OK, since Miller said an equal duty cycle was not a goal nor even desired.

Now, in a private communication, Miller has contradicted himself and says the waveform must be exactly balanced or some serious effects may result. I am unable to find any other warning of this in *73*. One of the characteristics of his own multivibrator is that it does not produce a balanced waveform, unless you carefully select components and measure the output to determine that it is indeed balanced. It is not likely that the many people using "Bioelectrifiers" have an exact 50% duty cycle, so be warned now. Miller warned that any unbalance will cause ion migration from the electrodes, and that heavy metal ions are both poisonous and cumulative. "Even silver ions absorbed in this manner are toxic. Any imbalance can also lead to more exotic problems, such as hydrogen gas buildup in the blood."

I'm 75 years old, but I still remember a lot from getting my BA in chemistry and I have a lab here at home, so I looked into his warnings.

My original circuit using the 555 oscillator has a 5% unbalance, so if you set it for 100 microamps output, there will be an effective five microamps in one direction. How much metal can this cause to migrate? The calculation is relatively simple and it shows that if you use the device with the five microamps unbalance for one hour per day for one year, the absolute maximum ion migration from the positive electrode (that is the one they leave) for the following electrodes is as follows: aluminum 0.61 mg; silver 7.35 mg; iron 1.90 mg; nickel 2.00 mg; chromium 1.77 mg; copper 4.33 mg. My doctor laughed at these tiny quantities, and said you would get more chromium by rubbing your hand on a car bumper. The iron, chromium and copper are essential minerals and you get more than those quantities in your food. Aluminum is not essential, but you get more than that every day in food, and a dose of most antacids puts you ahead by decades. Even a little ordinary baking powder gives you years of this amount of aluminum. Anyone who is allergic to nickel should stay away from any stainless steel that contains it, though many do not. As for the silver, the Merck Index™ says that any silver absorbed through the skin from silver compounds does not cause any serious toxic effects, but may color the skin gray. As far as being cumulative, that is doubtful, since if the other metals actually did pass through the skin they would be in ionic form, and chemically reactive with the body fluids. And as for the hydrogen buildup, if all the current was effective in forming hydrogen it would generate about a milliliter in the year. If all the current were concentrated in a single point and all went into making hydrogen gas, in one hour the bubble would be slightly over one millimeter in diameter, but, of course, it would form as an H^+ ion, which is already in the body fluids and would be lost with just a theoretical change in pH. And to use Miller's tactics, remember, I'm a chemist, not a doctor.

I did not stop at just calculations. I used pairs of various electrodes separated by pads of cotton, wetted one time by salt water, and again with commercial deionized water. Beck and others recommend using wet paper or flannel between the electrodes and the skin. I weighed the electrodes before and after. The tests were run with 945 microamps of direct current for 10 to 12 hours each. Only when using quarters as electrodes was there any migration of metal ions through the pads onto the negative electrode, and that amounted to only 0.1 mg with plain water and 1.1 mg with salt water. It was only the

Continued on page 84

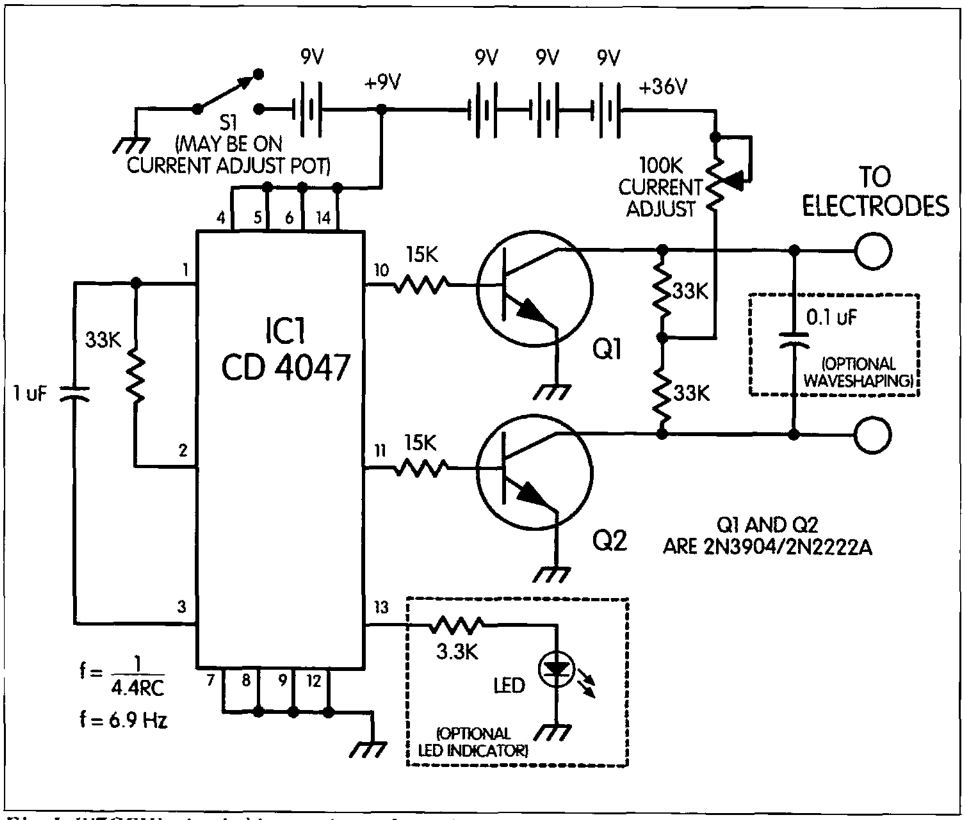


Fig. 1. W7GFH's simple bioenergizer schematic.

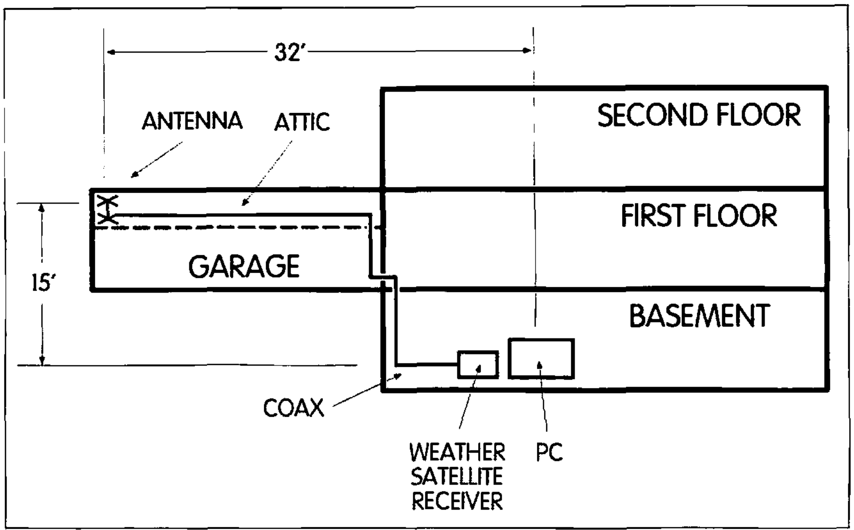


Fig. 1. 137 MHz interference being radiated from the basement PC to the antenna in the garage attic.

frequency range. All the frequency range labeling had been rubbed off. so I just picked a probe at random.

I connected it to my weather satellite receiver and began probing around inside the PC after powering it up with the case open. As I had suspected, the CPU chip generated a lot of noise at 137 MHz. The power supply leads were also very noisy. The disk controller card was noisy when I accessed the hard drive. As I pulled the probe a few inches away from the noisy locations, the signals dropped away to nothing. Aha! So this is how the professionals do it!

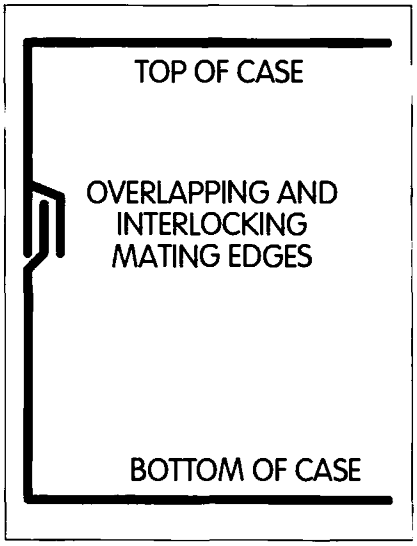


Fig. 2. Low-emission cases utilize interlocking panels to create an RF-tight enclosure.

I closed up the case, powered up the PC and began probing all around the case. The worst locations for EMI emission were the power supply fan air outlet, all along the sides of the case where the top and bottom panels meet, the I/O expansion slots at the back of the PC, and the front of the PC where there used to be a large five-and-a-quarter-inch hard drive. (I've since upgraded to an IDE hard drive, so this spot is empty—there is just a big hole there now, covered by a plastic snap-on panel.)

Again, where I work, we measure the electrical resistance between various parts of the products we manufacture. We typically specify that the bonding resistance be less than 2 milliohms—that's .002 ohms. I measured the resistance between the top and bottom panels at several ohms. This resistance changed value as I lifted the lid on my flip-top case, indicating that the bond between the top and bottom was very poor.

Between the drive bay (the bracket that holds the floppy drives) and the bottom panel, I measured an open circuit. The I/O expansion bracket that holds the plug-in cards was totally isolated from the bottom panel. The fan outlet is a big hole to RF since the fan is made of plastic and so doesn't block any RF. Likewise for the big hole that used to hold the hard drive. What I had was a bunch of floating metal panels

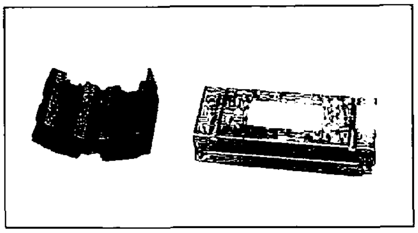


Photo A. Clamp-on ferrite filters are sometimes quite effective, but didn't help my PC.

that were not connected to anything! You don't need a probe like the one I used to clean up your PC—just follow my instructions and you should be able to do it quite easily.

The following parts and tools will be needed to complete the job:

wrist strap for preventing static damage to the sensitive motherboard and plug-in cards

screwdriver or small nutdriver socket to fit the metal tapping screws

electric hand drill

rotary wire brush for the hand drill

set of small-diameter drill bits

ohmmeter that can resolve resistances down to 0.1 ohm (most DMMs should work fine)

sheet aluminum approximately one-sixteenth-inch thick (a few pieces)

metal shears to cut the sheet aluminum

2 ceramic disc capacitors, 0.01 μF 1,000 V

1 miniature DPDT toggle switch rated at 250 VAC, two amps or better

an assortment of metal self-tapping screws

1 ferrite/iron toroid core, about one inch inside diameter

1 five-inch-square piece of metal window screen

10–15 sets of 6-32 x 1/4-inch screws, 6-32 nuts, and size 6 external or internal star washers.

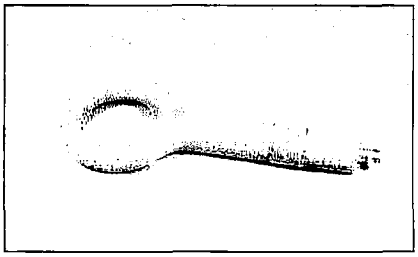


Photo B. EMI engineers use a probe like this to sniff out interference.

What you are going to do is create an RF-tight case. The case must be as near one solid piece of metal as possible. All parts must have good electrical contact with each other. When two panels contact each other for a long distance, you will need to provide several points of metal-to-metal contact. All large holes must be covered with metal plates or metal screen.

First things first

Begin by making a map showing where *all* the cables and connectors go. Note which way the ribbon cable connectors go on—most will fit either way. Mark each of the cables with a small dot of paint or marking pen, then make a similar dot on your map. See **Fig. 3**. Now go back and re-check the diagram against the PC itself.

Next, pull the AC cord from the PC and the wall. Then get a static strap so you don't zap any of the parts when you slide around in your chair and build up a nice healthy charge. Its function is simple: It drains all the charge from your body to the PC chassis through the wire and resistor instead of through the ICs. (This is also a good tool to have whenever you replace boards, add RAM or other times when you have your hands inside the PC.) Before touching anything inside, put the band around your wrist. Then connect the alligator clip to the power supply case. (Since I had a floating case, I had to pick some point as ground. The power supply had to be connected to all the electronic parts, so I chose it for the ground connection.) You will need to completely disassemble your PC down to the major component level. Remove the disk drives, power supply, plug-in cards, and motherboard.

When removing the power connectors from the motherboard and disk drives, be very careful not to apply too much twisting force—you could damage the circuit boards. The power connector on the power supply cable must be tilted away from its mate on the motherboard and then pulled straight up. Practice on a junk board if you've never done it before, or get some help from someone who has. Likewise, in

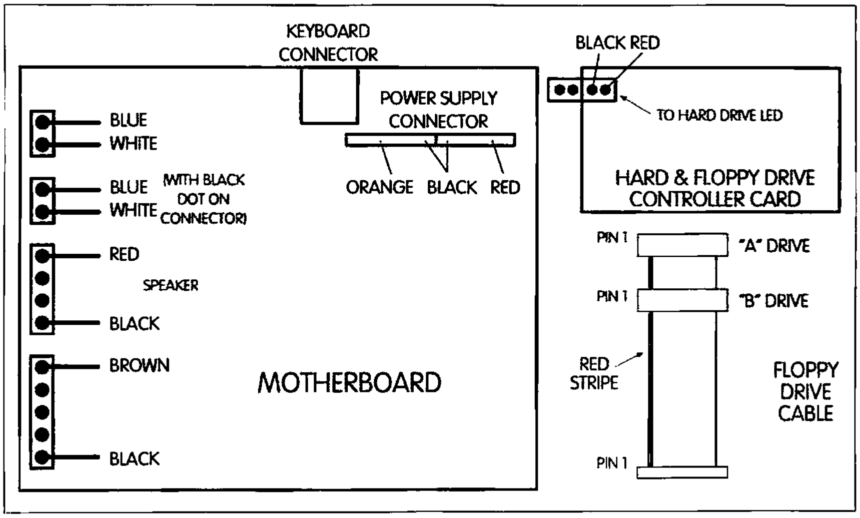


Fig. 3. Draw a diagram of your PC's hookup before disassembly.

reassembling the PC, use minimal force when plugging in the power connectors to the motherboard and disk drives.

Next take the case completely apart, including all panels and brackets that attach to each other with screws. My case is a flip-top that uses screws to hold the drive bay and I/O expansion bracket (located at the back of the PC) to the bottom of the case.

Power supply

Next we'll modify the power supply. Mine had a large red plastic bat-handle on/off switch on the side (see **Photo C**). I removed it and covered the hole with a piece of aluminum. (I measured a lot of leakage at this point, but I'm not sure that this size hole would allow 137 MHz energy to escape. It could have just been leaking out of the gap between the top and bottom panels right next to this switch.) Measure the resistance between the new aluminum plate added here and the power supply chassis, making sure you have a good connection.

Remove the voltage selector switch (see **Photo C**) and solder together the wires that the selector switch used to short together. In its place, mount a miniature DPDT toggle switch; it will be the new power on/off switch. The new switch plugs the hole nicely. I doubt that any RF would leak out here, but plugging it can't hurt. At the 115 VAC input connector, bypass both lines to ground with the .01-µF capacitors, using short leads. Make sure the capacitors' leads have a good, low-resistance connection to the power supply chassis.

While you have the power supply apart, vacuum it out. Most will have some dust inside, and some will have a lot of dust. The power supply will run cooler if the components don't have a blanket of dust to insulate them.

Remove the fan, noting which way it is mounted. When you replace it, you want the air to exit the back of the PC. If there is a stick-on label near the center, peel the label back and put a few drops of light oil on the shaft. Some fans I've seen also have a rubber plug that must be removed to get access to the shaft. Seal it back up with the label

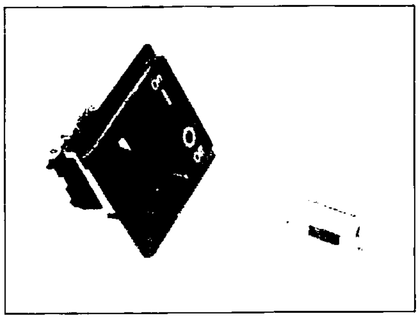


***Photo C.** The large plastic on/off switch was removed, and the hole sealed with an aluminum plate. The 120/240 VAC switch was removed and its wiring was bypassed, and the new on/off toggle switch was mounted in its place.*

place with a star washer between the parts. Tightening up the screws pro-

Photo F. Still another image from a NOAA weather satellite.

and rear panels of my PC are steel, so I had to select the drill bit sizes properly.

That's all you should have to do to make your case RF-tight. Remember to take your time, and make good notes and diagrams showing where everything goes *before* you remove anything.

Problems

I know you don't want to take apart your PC. After all, it does work properly and you might screw up something. Also, it does look nice. But remember, you can't hear those weather satellite or packet signals clearly! Proceed carefully while making the changes and clean up that noise!

There are several problems with these modifications. First, the PC won't look as nice as before since there will be some paint missing where the screws bind the top to the front and rear panels and the top and bottom panels together. Buy some matching touchup paint and go over the spots where you removed the paint.

Another problem is that it will take more work to replace cards, since you have to remove so many screws to get to the inside. Also, the threads in the panels will eventually strip after the screws have been removed/replaced a few times. This can be minimized by starting the screw by hand to make sure it engages with the thread already in place rather than starting a new one each time you put the screw back in place. My advice is to plan your changes carefully and make several changes at once if possible, or if you're unsure of a change, test it before you put the case back together.

I've included weather satellite pictures showing the quality of the pictures after the modifications (**Photos D, E, F**). I didn't bother saving any pictures with the noise in them, so I can't show you how bad they actually were. The pictures before modifications had two or three lines of noise (no picture data) every 10 to 20 seconds whenever the program wrote data to the hard drive. I wanted to show how bad the pictures used to be, so I removed the top of the case and began digitizing a satellite pass. To my surprise there was no interference in the receiver! Now I couldn't *force* the PC to interfere! Maybe you won't have to drill any holes in your case top/bottom to silence it. Try all the changes except for drilling holes in the case to see if that is adequate for your PC.

Other people have PCs similar to mine and don't have interference. Maybe I had a very noisy motherboard, an exceptionally leaky PC case, a bad antenna location, or the combination of all these. The bottom line is that I eliminated the noise and I learned a lot in the process.

By the way, you might keep this article handy. In the future, PC microprocessor speeds are only going to go up and the holes in your case that don't leak EMI now will let the higher frequencies right through! Microprocessors are running at 233 MHz in the new PCs now, with speeds twice that high probably not more than a few years away. The techniques in this article may help you later if you have problems with EMI.

If you make these changes to your noisy PC I would be interested in hearing from you. I'd like to know how it helped or if it didn't. Good luck—and go slowly when making the modifications. Remember, too, that tampering with your PC might void its warranty if there is one—be sure to check this if it matters to you.

And finally, many thanks to my wife for helping review this article and to

Earn cash for your cover shots.
Send to Joyce Sawtelle at 73 Magazine 70 Route 202N Peterborough NH 03458

Modifying Your Ramsey Transceiver Kit

One step closer to the ultimate ham experience!

Peter A. Bergman NØBLX
3517 Estate Dr. SW
Brainerd MN 56401

Kit building is fun; you start with a proven design and a good set of directions, you get to satisfy your creative urges, you don't need a junk box the size of Arizona—and when you finish you have the device you wanted, but you *don't* have a bunch of leftover stuff you didn't need in the first place. Been there, done that ... and I suppose if God lets me live long enough, I'll use it all some day.

Scratch building is a lot of fun. Some folks claim it is the ultimate ham experience. Modifying a kit you've built is a step closer to that ultimate experience.

When the subject of kit building is raised, somebody is bound to mention the boys from Benton Harbor—they aren't in the ham radio kit business anymore, though their kits were a lot of fun and are still generating modification articles. However, now we have several other companies producing a wide variety of ham radio-related kits. Ramsey Electronics is one of those companies.

I've built a number of kits, and the Ramsey FX-146 is one I use every day. The FX series of FM transceivers includes units for the 50, 146, 220, and 440 MHz bands. These rigs are diode-programmed, with a "box-stock" 12-channel capability.

The diode programming may sound a little primitive, but it has definite advantages for a mobile operator like myself. My job requires that I be on the road at all hours in all kinds of weather. The simplicity of operation found in a rig like the Ramsey FX lends itself to that environment.

Some forethought is required when choosing frequency pairs. This led me to explore methods of adding to those 12 channels. One of these methods was described in an article in the January 1997 issue of *73*. After using my modified FX for awhile, I decided it would be really nice if it had a −600/simplex/+600 switch. It took longer to figure out how to add that feature than it did to install it.

Having very little formal electronics training, it took me a while to realize that it doesn't matter how a programming line gets turned on. I'd been thinking I'd have to switch the offset diodes for each programming line. Anybody have a 12-pole, three-position switch? That will fit inside my FX? Cheap?

All that is actually required is a single-pole, three-position switch and three each 1N914 or equivalent diodes. If you are worried about a world shortage of 1N914s, you could get by with a single diode. I prefer the redundant approach. If one of the diode switching lines fails, I'll still have two possibilities to use.

There is room for a reasonably-sized switch on the front panel between the squelch control and the channel switch. Once the switch is mounted, remove all the +repeat, −repeat, and simplex diodes from the matrix. Install 1N914 or equivalent diodes in the extra programming line at the +RPT, -RPT, and SIMP positions. Then run a lead from each of them to one of the positions on

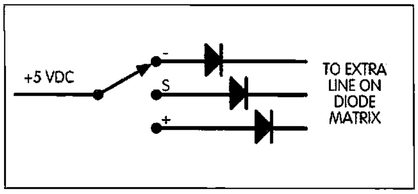


Fig. 1. Offset switch: Remove all other minus, simplex, and plus diodes from matrix. Pick up 5V from front center of board.

the switch. Minus, simplex, plus seems to be a pretty common arrangement, but there is no hard-and-fast rule, so do what seems best. Connect a short lead from the +5-volt pad on the front edge of the board to the switch wiper, and you're in business. (See **Fig. 1.**)

Adding this feature greatly increases the operating flexibility of the FX rig. During emergency or public service operations, it is not uncommon to find the repeaters and "standard" simplex frequencies all in use. Choose an unoccupied repeater output frequency and use it simplex. Some repeater outputs are used with either a plus or a minus input, depending on where the repeater is located. For example, 147.030 uses a plus offset here in Brainerd, but a minus offset in Wilmar, Minnesota, and Sedalia, Missouri.

This modification is easy to install and will work on any of the FX-series rigs, so give it some thought. On the other hand, things get a bit more complicated if you are using the auxiliary line to provide a nonstandard offset.

The aux line is turned on through a diode connected to the back end of the appropriate diode bridge. If you follow the suggestions given above, strange things are likely to happen when you switch to the channel using the nonstandard offset. Suppose you have the Civil Air Patrol frequency of 148.15 with its minus 4.25 MHz offset in one of the channels and ham repeaters in all the others. When you turn to the CAP channel the aux line will be telling the processor to do one thing while the plus-simplex-minus switch is telling it to do something else. I have no idea where the output will actually be. Something must be done—unless you want calls from the FCC ... or, conceivably, the Pentagon.

From the operator's point of view, the simplest solution is to use a two-pole switch with four or more positions. When the aux line is turned on, everything else in the matrix must be turned off to prevent unpredictable frequency excursions. That is why a two-section switch is needed (see **Fig. 2**).

The first three or however many positions of section A select the standard

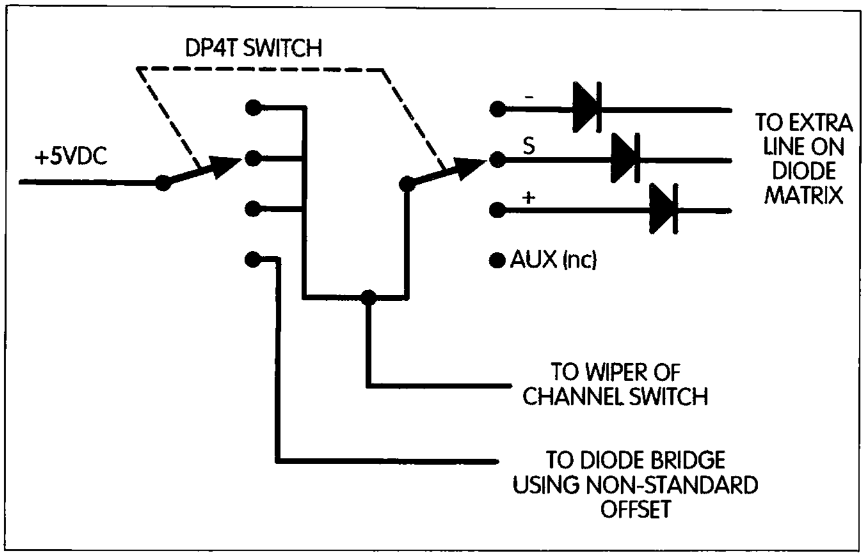


Fig. 2. Control arrangement when using nonstandard and standard offsets.

offsets or simplex. The last position on section A is not connected. The last position of section B will turn on the diode bridge connected to the auxiliary offset line. Tie the other positions of section B together and use them to feed five volts to the wiper of section A and the wiper of the channel switch. This will free a position of the channel switch, allowing a 13th frequency to be programmed. There is already room on the matrix, so we might as well.

If your junk box doesn't produce a two-pole, four-position switch, try Radio Shack™ #275-1386A. It's a two-pole, six-position switch, but you can cross-connect some of the positions. An arrangement like plus, minus, simplex, plus, minus, auxiliary works fine.

After I had reached this point, I decided I needed some sort of indication of the offset switch position. I wanted it simple and easy to read, at a glance, in the dark. I had already installed a bicolor LED so that it was green at channel one and red on the non-ham frequency. I figured a couple more LEDs wouldn't hurt. I arranged two T1s and a rectangular LED like a "divided by" symbol. The horizontal rectangular LED indicates a minus offset; the double dots indicate a plus. When the bicolor turns red, I'm on the non-ham frequency. There is probably a more sophisticated way of doing it, but this works.

Now that I have this mod working, I wonder if I have room for a plus 5 kHz switch. Hmmmm ... 73, NØBLX.

Out of Sight, Out of Mind

Discretion is the better part of neighborhood amity. Part 2: hardware.

Kevin Scott WB4BNU
1939 McLennon Court
Lawrenceville GA 30043

In Part 1, we went over ideas for putting an antenna system together in places that don't allow for a "visible" antenna. Here, in Part 2, we'll review a camouflaged multiband remote-tuned vertical antenna that I put together and am now using successfully. I was really amazed when I turned on my rig to 160 meters one night and discovered a contest in progress. I am usually not a contester, but here was a good opportunity to work on my WAS and to test my new antenna at the same time. In that one contest weekend, I worked over 35 states!

There are three major parts to this antenna—as with most designs, especially verticals: the ground system, the radiating element of the antenna itself, and the remote tuner. The first two were mentioned in Part 1 of this article, but we will briefly review them again here.

Ground system

For my setup, I placed eight to 10 runs of 12-gauge insulated solid copper wire on the ground running out radially from a proposed future antenna site. This was done just before I put down the sod in my back yard, which turned out to be a lot easier than burying wire in an existing lawn. Besides occasional tripping over the radials while putting down the sod, the extra effort was minimal. I soldered all the radials together at the middle to finish things up. Some of these radials are 100 feet while others are about 40 feet. The results on 160 and 80 meters, so far, have shown no perceivable directional characteristics of the radiation pattern of my antenna because of the asymmetrical radial placement. It may not be a broadcast AM station setup with 120 quarter-wave radials, but it works for me.

Antenna's radiating element

In the "Commandments" section of Part 1 of this article, I urged, "If you have trees, use them."

To get an antenna wire up in a tree where I want it, I use the following materials and method. First, the materials:

a hunting slingshot,
a half-ounce lead weight,
a fishing pole with eight-pound test on a spincasting reel,
and nylon twine.

Now the method: Attach the lead weight securely to the end of the fishing line. Make sure the pole is aimed at the spot where you are shooting and mounted firmly so that the line moves freely. Load the slingshot with the lead weight, aim and shoot (but don't aim near your neighbor's windows in case the weight comes off the fishing line). Once the lead weight and the fishing line fastened to it have reached the ground (you may have to coax the weight down by giving the line some slack from the fishing pole, and shaking it if necessary, depending on tree branches and foliage), remove the weight and tie the nylon twine onto the end of the fishing line. Knot-tying from Boy Scouts has proved invaluable for making streamlined knots that resist getting hung up around the branches (the sheet bend knot works best). Now, go back to the reel and wind in the line until you reach the nylon twine. With twine in hand, you should be able to hoist just about any size wire you want to use.

Next, camouflaged green Dacron™ rope is tied to the nylon twine and pulled back through. Attached to the rope is the antenna wire. This Dacron

rope is chosen to support the other end of the antenna wire as well as to blend in with the natural foliage. Also, since the nylon twine is fairly visible, I certainly do not want it to be used as an antenna support and give away my "secret." Using this method, I was able to get an antenna wire over the highest branch of the tallest tree in my back yard. This took many attempts since there was a light breeze blowing the fishing line away from the tree, or to a different branch, but patience paid off. This system using the slingshot and more as described above has worked wonderfully throughout the years, although I occasionally do get puzzled looks from my neighbors.

For the vertical antenna, the radiating section is an insulated and spray-painted (several camouflage colors) 20-gauge multi-stranded wire (one side of a zip cord split in two) that runs to the top of the tree (55 feet) and loops back down again. Each end was soldered together at the base and connected to the antenna tuner input. This loop configuration gives the antenna a little larger capture area than if the wire had just been run to the top and had a support rope coming back down on the other end.

Remote antenna tuner

Many articles I have read about remote antenna tuners virtually require the reader to have a machine shop, or at least have a varied assortment of gears and motors. For me, this is too much effort, especially since I am not loaded with tools like Tim Taylor on *Home Improvement*. However, I do have a soldering iron and a modest assortment of electronics tools, so when I received a catalog supplement from Fair Radio Sales with a commercially-built remote HF antenna tuner for $30, I knew I had to check into this further. Much to my surprise, this tuner was a real gem and a bargain. They also offer the same tuner without the roller inductor for $17. Since my design does not use a roller inductor, this tuner would be ideal. If you want a roller inductor for another future project, then get the $30 tuner. A roller inductor of this quality purchased by itself would cost you a lot more than the $13 difference (see **Table 4** for Fair Radio Sales part numbers).

Original Tuner Connections (as received from Fair Radio)		
RF Switch Position #	**S1A Connected To:**	**S1B Connected To:**
1	24th turn from bottom of L2	L2 bottom tap
2	top of L2	L2 bottom tap
3	18th turn from bottom of L2	L2 bottom tap
4	position 2 of S1B	S1A position 2 (shorts coil to ground)
5	C27 rotor	C27 stator
6	15th turn from bottom of L2	L2 bottom tap
Com	vacuum cap connection and to L1 roller inductor	external connection

***Table 1.** Original tuner connections (see Parts List for Fair Radio parts numbers).*

Fig. 1 is a reverse-engineered schematic of the tuner as purchased—including the roller inductor that is available on the $30 tuner and the vacuum variable capacitor (missing) that was on the original tuner. Depending on your needs and your antenna's impedance, you may be able to use one of the settings of the tuner as it is wired. However, to make this a multiband tuner, read on.

For my installation, I used a 55-foot vertical wire working against a ground radial system (described in Part 1). This antenna tuner works from 160 to 10 meters (excluding 12 meters for now). Most likely your system will differ from mine, but here are some helpful hints that should steer you in the right direction for your unique antenna design and setup.

1. For 160 through 10 meters, if your antenna is longer than 55 feet but less than 66 feet: Reduce the inductance of the loading coil. Change the 80 meter tap to short out the loading inductor (not needed).

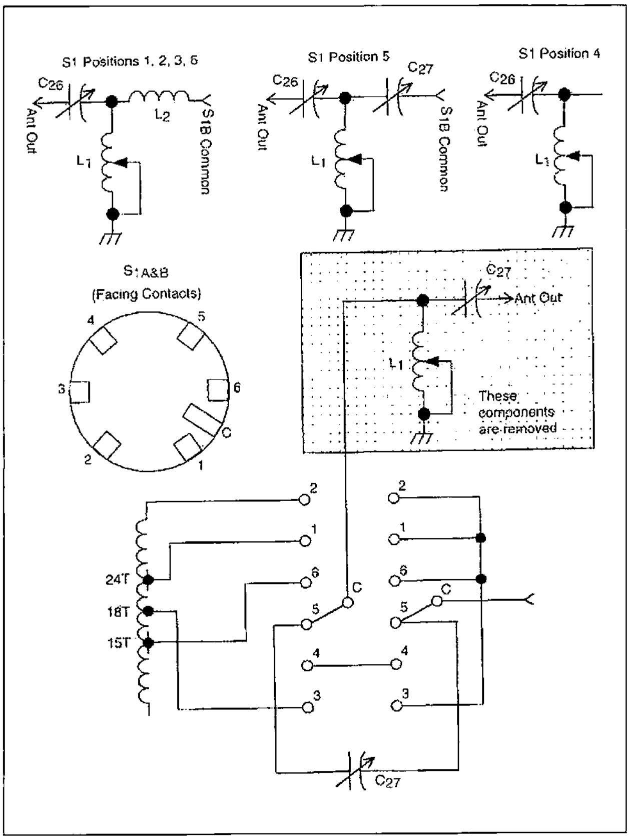


***Fig. 1.** Reverse-engineered original tuner diagram. L2 at bottom left.*

If you are at the resonant frequency, the tuning capacitor should be able to dip your reflected power to near zero. If you are off, you may only be as low as 1.5:1, which is still OK. It depends on how picky you are about finding that perfect match point. With the right match point, I found that the tuning range of C27 was sufficient to achieve a low SWR across each band. 160 meters was the only exception, although 80 was just barely 2:1 at the band edges (worse at the lower edge). The retuning of capacitor C27 is necessary to operate across each larger band with a reasonable SWR level.

Antenna Coupler Cross-Reference

J1 Connector

Pin	To feedthrough cap #	To rotary switch and position #	Tuning capacitor C27 rotor/stator plate condition	Connected to remote tuner control box?
1	C20	S2 - 5		Y
2	C21	S2 - 6		Y
3	C19	S2 - 4		Y
4	C16	S2 - 3		Y
5	C15	S2 - 2		Y
6	C6	S3 - 1	5/8 mesh	N
7	C7	S3 - 2	3/8 mesh	Y
8	C8	S3 - 3	1/4 mesh	N
9	C9/C10	S3 - 5	1/16 mesh	N
10	C9/C10	S3 - 5	1/16 mesh	N
11	C11	S3 - 4	1/8 mesh	N
12	C12	S3 common		Y
13	C13	S3 - 7	1/16 mesh	N
14	C14	C27/S3 motor B+		Y
15	C5	S3 - 10	7/8 mesh	N
16	C4	S3 - 6	edge of mesh	Y
17	C17	S2 - 1		Y
18	C18	motor B-		Y
19	C3	S3 - 11	full mesh	Y
20	C1	S3 - 12	7/8 mesh	N
21	C2	S3 - 9	3/8 mesh	Y
22	C22	S2/L2 tap switch motor B+		Y
23	C23	S2 common		Y
24	C24	originally unused (now K1 relay coil hot)		Y
25	C25	originally unused (now K2 relay coil hot)		Y

Other modifications: Connect top of L2 to stator of C27; connect rotor of C27 to ground.

Table 3. Clip diodes across motor windings to allow for forward and reverse direction of motors.

Tuning up (manual)

To test the tuner, you will need to connect power to it to run the servo motors as well as the external relays if you are using them. It is important that you clip both diodes mounted on the feedthrough caps if you want a bidirectional motor control. This makes tuning a whole lot easier. The motors are 24 volts but run well at 14 volts (from the radio power supply). I used short alligator clips for most of my "field tuning" when setting up the correct taps and for motor control. All work was done at the base of my antenna (sometimes in sub-freezing temperatures after dusk) to speed up the trial-and-error process of optimal tap finding.

The following is for 40 through 10 meters. 80/75 and 160 are explained at the end.

1. Connect your rig to J1 with an SWR meter in line.
2. Connect the antenna to be tuned to the antenna contact of K2.
3. Connect power to the motor driving S1A/B to rotate the switch to your desired band position as noted in **Table 2.** Remove power when you have reached the desired switch position.
4. Connect an alligator clip lead from the lug of S1A (from #3 above) to the appropriate tap on L2 (position as noted in **Table 2**).
5. Energize relay K2 or short it out, using very short alligator clip leads to approximate the true antenna length.
6. Set your rig to low power and transmit to get an SWR reading. While watching the reflected power, energize the servo motor that moves C27, and tune it until a dip in the reflected power is observed. If no dip is noted, then recheck your connections. You may also need to move the clip lead to another tap on L2 to find the resonant point of your antenna (trial-and-error). Once you have found the resonant tap, solder a wire from this tap to the appropriate solder lug on S1A.

Hint: If you have a variable cap that is equivalent in size and value to C27, you can speed up your tuning process by setting C27 at minimum capacity

and connecting your substitute cap in parallel. Make sure that the rotor is connected to ground (same as the rotor of C27) and the stator of your capacitor to the stator of C27. Also, make sure that you have an insulated knob on the capacitor so you can tune it quickly by hand without getting RF burns. You should be able to find the SWR dip much faster and zero in on a minimum SWR.

7. Repeat step #6 for each band. Some bands will share the same tap. In my setup, 10 and 15 meters shared the same tap (although 12 meters did not tune properly), as did 17 and 20. 75 (phone section) and 80 meters (digital section) use the same tap, but this is a compromise to cover as much of the band as possible without having two taps for each subband. This was done because there weren't enough switch contacts available on S1A or B (unless you choose to eliminate 160 meters). To get full band coverage on 160 meters, position 6 is for the high end of the band, while in between any of the positions yields full loading inductance, to work the low end of the band. It's a sneaky way to get seven positions out of a six-position switch.

Remote control

The heart of this article is to design a *remotely controlled* antenna tuner—one that is also easy to build and operate. Most of the items used are available at Radio Shack™. Refer to **Table 2** for the reverse engineering of the DB25 connector and what is connected to each of its pins. I happened to have some surplus 12-pair telephone cable lying around, so I had the luxury of connecting nearly everything in the tuner to the shack's remote control box. If you want to keep it simple, use one to two runs of rotor cable (depending on the number of conductors) and connect the following as a minimum:

1—C27 B+
2—S1A/B B+
3—Motor B- (separate from ground)
4—K1 relay coil hot
5—K2 relay coil hot
6—S2 common
7—S2 position 1
8—S2 position 2
9—S2 position 3
10—S2 position 4
11—S2 position 5
12—S2 position 6

Switch S2 rotates with S1A/B and indicates which band position the switch is in. Without this feedback, you will have to guess which band you are on—which is not a good idea. It is well worth it to have the LED position indicators. The capacitor position indicators can be eliminated, if you don't have enough wire pairs, and especially if you don't care to know if the capacitor is moving. It should be obvious by the change in the SWR level during tuning.

Fig. 3 and **Table 2** are essential for correctly wiring your control box to the appropriate connection on the DB25 connector of the tuner, so refer to each of them regularly when wiring the system up. What I have listed in the connection scheme is a bit overboard for some, but I did have that long run of 12-pair jacketed phone wire at my disposal. I found that the 24-gauge wire used in the cable was more than sufficient to drive the motors from my shack, located over 75 feet away, with little IR loss—even running at 14 volts. Depending on what kind of wire you may have lying around, feel free to customize your own station setup. I do, however, recommend the minimum 12 connections as previously mentioned.

Note: In **Fig. 3**, the motor control common is tied together for both motors. I highly recommend that you rewire the tuner to split the motor common lines for each motor. This could be done easily by eliminating one of the LED indicator lines for C27 as wired on the tuner's feedthrough caps. As wired and shown in **Fig. 3**, if switches S4 and S5 were put in the wrong position at the same time, you would short B+ directly to B-. I didn't notice this until after I had completed this project and I have not had any problems, but I have been very careful, and I will be fixing my setup.

Continued on page 26

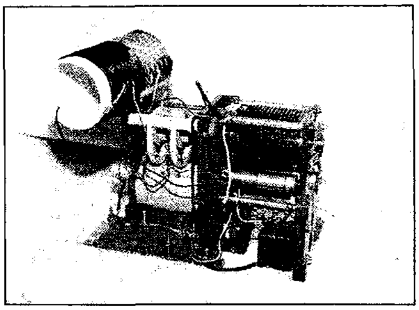


Photo D. Completed tuner assembly, front view.

Fig. 4 is used as a simple but functional layout for the remote tuner box and its associated switches and LED bar graph. If you have a better idea or have other junk boxes that you would prefer to use, then by all means do so. Be creative, but make it functional.

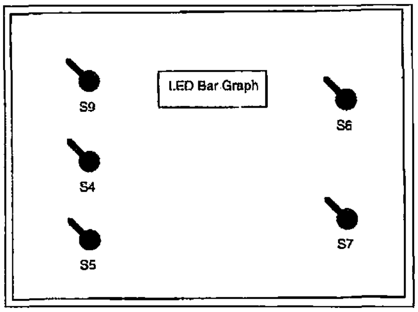


Fig. 4. Suggested panel layout for remote unit.

Outdoor tuner housing

Last but not least, you will need a box to put the tuner in to keep it out of the elements. Fair Radio Sales also has some good deals on enclosures, such as three Fiberglas™ ones for $15 [*readers should always check for current pricing—ed.*]. After some internal mounting hardware is removed from these boxes, the tuner easily fits inside with room to spare. Note that these boxes are weather *resistant* and not weather*proof*. Weatherproof would be better, but with some silicone caulk at key locations, they are good enough and the price is certainly right. If you have access to other types of weatherproof boxes, use them. I prefer to avoid the clear plastic food containers as they usually get destroyed by U/V radiation rather quickly. The Fiberglas boxes or those specifically designed for outdoor use should last for years.

For the antenna connection post, I used another brass bolt fed through the box housing and bolted securely to the box. An extra set of washers both inside and outside is used to wrap the bare wire of the antenna (outside) and connect to the tuner (inside). The entire box was mounted to a steel fencepost that is easily pounded into the ground. A wooden fencepost would be just as useful. As mentioned above, parts are available from: Fair Radio Sales, P.O. Box 1105, Lima OH 45802; telephone (419) 223-2196 or (419) 227-6573.

Conclusion

So there you have it: a complete remote antenna tuning system at a penny-pinching price. I hope you have realized from reading this article that my antenna system is not meant to be duplicated exactly; build what is right for you and your setup. I have tried to present alternatives that would help steer you in the right direction for your specific antenna setup. Use your own imagination to make what is best for you. After all, isn't that what got you into ham radio in the first place?

Parts List

Tuner	
Tuner/w roller inductor	*AL-AM3349-96
or Tuner w/o roller inductor	*AL-GRC-106
Fiberglas™ case	*FIB-SR-684
RF relays (K1, K2)	*50F212DC
C27a - 300 pF cap (for 160 m)	*various high-voltage types
Loading inductor	at least 50 µH (see text)
DB25 Female	**276-1548
Remote	
Project circuit board	**276-168
LED bar graph	**276-081
20-position DIP socket	**276-1991
Fuse, 1 Amp fast-acting	**270-1273
Fuse holder	**270-1281
R1–R10, 1 kΩ, 1/4 W	**271-1321
S6–S9 SPST switch	**275-634
S4, S5 DPDT switch, center off	**275-664
Power connectors for box	**your preference
Enclosure box	**270-223 or equivalent
To connect remote box to tuner:	
Rotor cable	**278-874 or equivalent

* Fair Radio Sales part #
** Radio Shack part #

Table 4. Parts list with author's recommended part numbers.

Techno-Trouble for Know-It-Alls

How many of these 50 questions can you answer correctly?

Steven D. Katz WB2WIK/6
21101 Celtic St.
Chatsworth CA 91311

Newcomers and old-timers alike hold misconceptions regarding our hobby. Both technically and operationally, only a handful out of every 100 licensed amateurs really understand what it's all about—sad, but undeniable. The source of my "statistics" is my own experience in meeting with fellow hams at radio club meetings, swap meets and hamfests, and, of course, on the air.

As we have "dumbed down" the hobby—and it is absolutely dumbed down compared to 30 or 40 years ago—hams have become appliance operators who memorize question pools to pass their exams. Many have come from the CB ranks, where they were exposed to much misinformation represented as technical fact. Even many old-timers create their own realities based on unfortunate experiences that are not the norm. I'll offer some examples in this article.

Take a few moments to answer these easy questions, and see if *you* arrive at the correct conclusions. Each is a "true or false" question with only one right answer.

1. A great indicator of an antenna's performance or efficiency is having a low SWR. **T/F**

2. If your SWR meter or bridge, or directional wattmeter located near your transmitter, indicates a low SWR, both your antenna and transmission line are probably good. **T/F**

3. If you increase the height of your 40-meter dipole from 20 feet to 40 feet above ground, your station performance will increase by approximately 3 dB. **T/F**

4. If you increase the height of your two-meter vertical antenna from 20 feet to 40 feet above ground, your station performance will increase by approximately 3 dB. **T/F**

5. If you want to add a two-meter "brick" power amplifier to your station, and locate it near your rig (in the shack), you definitely want to use one with a built-in low noise preamplifier, to help pull in the weak signals. **T/F**

6. Your 12 VDC-powered, 100 W output transceiver or amplifier should be connected to its power supply by #12 gauge wiring, as long as the wiring is not longer than 12 feet. **T/F**

7. It is safe and permissible to run a 1,000 W output amplifier powered by a 115 VAC power line in your home. **T/F**

8. An ideal two-meter "base station" antenna system for FM use would be a pair of stacked 13-element yagis. **T/F**

9. A pair of two-meter vertical antennas, installed at least one wavelength apart horizontally, with a shack-mounted phase shift network to adjust the phasing between the antennas, would be a better choice than the pair of 13-element yagis discussed in question #8 above, for most amateur work. **T/F**

10. It is important to cut your coaxial cable to exact increments of one-half wavelength at your operation frequency in order to achieve optimum performance from your antenna system. **T/F**

11. It's a good idea to install a 1,000-ohm carbon composition resistor across the feedpoints of your base station antennas that are not of "DC-grounded" design. **T/F**

12. The loss in coaxial cable is proportional to its length, but inversely proportional to its velocity factor and the diameters of its inner and outer conductors. **T/F**

13. "Open wire" transmission line, or "ladderline," is a great choice for very low-loss or high-power operation at 146 MHz. **T/F**

14. To directly bury coaxial cable, be sure to use cable rated for "direct burial." **T/F**

15. The path loss for Earth-moon-Earth propagation on two meters is about 260 dB. **T/F**

16. The path loss for Earth-moon-Earth propagation on 40 meters is somewhat lower than it is on two meters. **T/F**

17. TVI problems resulting from six-meter transmission can usually be cured with an effective high-pass filter installed at the television set. **T/F**

18. You should always use a low-pass filter on your HF (3–30 MHz) transmitter or transceiver, to reduce harmonic radiation on 80, 40, and 20 meters. **T/F**

19. Use a balun installed at the center of your HF dipole to help provide the lowest possible SWR. **T/F**

20. If you use an antenna tuner or transmatch in the shack, to help tune your coaxial cable-fed antenna, this will reduce transmission line loss and stresses on the cable itself. **T/F**

21. When you are operating in a different US call area other than the one indicated by your license callsign, it is unnecessary to sign "portable." **T/F**

22. The modes of transmission, listed by order of efficiency from best to worst, are CW, RTTY/AMTOR, SSB, FM and DSB AM. **T/F**

23. The voltage across the feedpoints of a 50-ohm antenna system operated at resonance, when running legal-limit (1500 W PEP output) power, cannot be higher than 274 volts peak. **T/F**

24. UHF (PL-259) coaxial connectors all have loss when used at 146 MHz. **T/F**

25. When installing connectors on coaxial cable, be sure to weather-seal both ends of the cable extremely well. **T/F**

26. A good way to support coaxial cable when routing it to your antenna is to tightly tape it to the antenna mast, tower, or other supporting structure using high-grade electrician's tape. **T/F**

27. Copperclad (copper-coated steel) wire makes the best wire antennas. **T/F**

28. Given a choice, a mountaintop is always the best operating location. **T/F**

29. The highest Field Day score ever made was by a multi-operator station running kilowatts on all bands. **T/F**

30. Meteor scatter is a great way to work long distances on 1.2 GHz. **T/F**

31. Good advice for setting up a new station would be to spend most of your budget on a great transceiver, then use what is left over for your antenna and transmission line, then station accessories. **T/F**

32. Headphones are an annoyance which will not let you hear weak signals any better than will a good speaker. **T/F**

33. If you want to work DX, the best time to do it is when everybody else is working it. **T/F**

34. There is considerable danger associated with operating high power and using a low antenna close to your operating position. **T/F**

35. Using double-shielded coaxial cable will normally help reduce TVI. **T/F**

36. It is best to install a solid station ground, using an eight-foot ground rod as a minimum, to optimize station performance and reduce interference. **T/F**

37. Clamp your antenna tower securely to the side of your house to make it stronger and reduce the need for other guying. **T/F**

38. PVC is a good material for antenna masts and booms when nonconductive mounting is desirable. T/F

39. The best conductor in the world is gold. T/F

40. 50 ohms was settled on for standard coaxial transmission line impedance because it results in the lowest possible loss, and because this is the natural impedance of a half-wave dipole in free space. T/F

41. FM repeaters were originally established and allowed for amateur work in order to enhance the range of base-station operators. T/F

42. Multipath distortion on VHF-FM can usually be solved on a case-by-case basis by simply moving your antenna slightly. T/F

43. The lower the operating frequency, the longer the wavelength, and the better the long-range propagation. T/F

44. Radio waves travel in space at a speed of about 300,000,000 meters per second; at this rate, it takes less than three seconds for a signal to propagate from Earth to the moon, and back! T/F

45. An important factor in antenna or transmission line performance is to use materials with the lowest possible DC resistance; for this reason, solid conductors work best. T/F

46. Aluminum antennas usually require frequent maintenance because contact surfaces oxidize and increase resistance. T/F

47. It is best to replace your outdoor coaxial cable every 20 years, even if it still looks good. T/F

48. The problem with tube-type transmitting amplifiers is that they require tuning, and the high voltages used create the need for low-loss wiring. T/F

49. A quarter-wave whip, single-band mobile antenna normally has a transmit power rating of 200 watts. T/F

50. If you use 100 feet of coaxial cable to feed your station antenna, you are going to lose at least 30 watts of transmit power in the cable. T/F

Easy ones, huh? Check your results. The real answers appear below:

1. *False*. A low SWR results from matching the antenna impedance to the transmission line impedance and indicates absolutely nothing else. A good dummy load will have a perfect SWR and won't get out worth a darn.

2. *False*. Beware of false idols. A really great SWR can often mean excessive transmission line loss. Since transmission lines increase in loss without significantly changing impedance, the more lossy the line, the better the SWR will read. A 10,000-foot length of good 50-ohm coax, connected to absolutely nothing on the other end, will normally read a "perfect" SWR.

3. *False*. Impossible to accurately predict without knowing several variables, but in general the improvement in signal strength at most useful radiation angles, especially lower angles desirable for DX work, will be *much* more than 3 dB. A 20 dB improvement is not unusual. Still, there is no magic dB-per-foot formula.

4. *False*. Also impossible to accurately predict without knowing several variables, but in general the improvement, measured at distances beyond the original horizon, where signals get weak, will be *much* more than 3 dB. Again, there is no dB-per-foot formula.

5. *False*. Unless you have a very short, near-zero-loss transmission line, the preamp won't help. It will make your S-meter read higher, but will normally multiply noise and signals equally, resulting in absolutely no improvement in actual readability. Weak signals lost in your transmission line (between the antenna and preamplifier) are lost forever and cannot be recovered with a preamp. Unless your receiver is nearly dead to begin with, a shack-mounted preamp, used at the base of a normal home station transmission line (e.g., 100 feet of coaxial cable) is not likely to help—indeed, is much more likely to hinder—weak signal reception under crowded band conditions. The true test of a preamp is: Look for a very weak, barely readable signal that doesn't even move your S-meter. Close your eyes and listen to it very carefully. Then, turn on the preamp. Listen again with your eyes closed. Sound any different?

6. *False*. 12 feet of #12 gauge copper wire will drop about one-half volt at 15 amperes and create less than ideal

operating potential for your equipment. Go for at least #10, or preferably #8 gauge. You will notice most standard factory-supplied DC cables for 100 W or higher-powered radios is much heavier than #12 gauge. There's a reason.

7. *False*. Assuming a 65% efficient amplifier, to run 1,000 W out, you'll need to provide 1538 VA (volt-amperes, the AC equivalent of a watt) to your amplifier. At 115 VAC, this is 13.4 amps—way too close to the household wiring maximum rating of 15 amps, especially for sustained operations or when the amplifier shares the line with other equipment. Rewire for 230 VAC, and the current required will drop in half. Your amplifier, its power supply, and your household wiring will thank you for it.

8. *False*. This might make a great point-to-point system for a fixed and known path, but for general operating it will be a nuisance and make it difficult to contact stations in more than one direction at a time. After following a few dozen weak mobiles around, your rotator will age years in just days, and probably so will your patience.

9. *True*. And cheaper, and easier to install. And by using a two-pole multiposition transfer switch or relay system, in conjunction with various lengths of short patch cables, you'll be able to instantly "rotate" your antenna without anything physically moving. Fast, efficient, and inexpensive. And a more user-friendly system than rotating long beams.

10. *False*. Where in heck did this silly rumor start?

11. *True*. The presence of this resistor will help you pinpoint future problems, should any occur, and will not affect the performance of a 50-ohm antenna system in the slightest. Any time you wish to check your antenna or feedline connections, just disconnect the coax from your radio and use an ohmmeter to measure across the connector. It should measure 1,000 ohms. If it measures less, something is starting to short out. If it measures more, something in the system is becoming resistive. Either way, it should be investigated and fixed.

12. *True*.

13. *False*. Open wire or ladderline is high-impedance (450–600 ohm) transmission line with wide conductor spacing that is a bit *too* wide for most general VHF applications. Its radiation loss can cancel out its benefits. Also, it is difficult to convert from this high impedance back down to what most of our antennas and radio equipment were designed for; the transformation networks (baluns, etc.) will have loss at VHF that can also cancel out the other benefits of open wire line.

14. *False*. Any coaxial cable can be buried if you are careful not to nick or cut the outer insulation. Some cable types are rated "direct burial" because they have "flooded" construction, which is more suitable for this application. However, pulling any old coax through inexpensive half-inch PVC pipe (the kind used for lawn sprinkler systems) will turn just about anything into "direct burial" cheaply and easily.

15. *True*.

16. *False*. A 7-MHz signal transmitted from Earth won't reach the moon—it will reflect off the ionosphere and bounce back to Earth.

17. *False*. Six meters (50 MHz) is so close to television Channel 2 that high-pass filters rarely do much good. Might be worth a try, but don't count on miracles.

18. *False*. A low-pass HF filter has a cutoff frequency of 30–33 MHz. This allows the first nine harmonics of 80 meters to blast right through it! Also allows the first four harmonics of 40 meters, and at least the second harmonic of 20 meters, to blast through unattenuated. A low-pass HF filter is of most good on the bands above 21 MHz. Most modern-day equipment, if not tinkered with, is pure enough to not require additional help from outboard low-pass filters.

19. *False*. Another silly rumor.

20. *False*. Won't do a thing to reduce line loss or stress on the coax.

21. *True.*

22. *True.* Efficiency is inversely proportional to bandwidth. Bandwidth is directly proportional to data I/O rate (baud). CW, being slowest, is still most efficient.

23. *True.* Doesn't sound like much, does it?

24. *False.* While *everything* has some loss, including a cubic foot of solid silver, the loss in a properly installed PL-259 at 146 MHz is so low you can't measure it with conventional instruments. In fact, a line splice properly made using two PL-259s and a PL-258 double-female adapter (barrel) measures less than 1/10 of 1 dB loss at 146 MHz. This is an imperceptible change.

25. *False.* Weather-seal the antenna fitting, for sure! It doesn't pay to weather-seal the shack end (indoor) fitting. Let it breathe a bit, so changes in barometric pressure (which occur daily) will allow the same changes inside the cable. This helps avoid condensation building up inside the cable.

26. *False.* Coaxial cable, other than hardline types, is soft and should not be overly compressed. Several layers of tape, pulled taut during installation, can be detrimental to the health and life of your cable. Tape is OK, when installed in sweeping, loosely overlapped layers occupying several inches of cable at a time. Don't pull it too tightly.

27. *False.* Steel is strong, but that's its only benefit. The copper usually flakes off the steel in an alarmingly short time, leaving rusty steel exposed. When this occurs at connection points, even if they are soldered, it can increase resistance and degrade antenna performance. Stick with pure copper for best long-term results.

28. *False.* Depends on the frequency, propagation and location specifics. The "lowfers" (low-frequency operators, using 1.8 and 3.5 MHz, for example) usually find a beachfront to be a better location than any mountaintop—and even some VHF propagation favors lower elevations. There are too many variables to make a general rule on this one.

29. *False.* Highest score was set by the Conejo Valley ARC (in California) a few years back, using 5 W maximum output power on each band. It's a record that hasn't been broken yet by anybody. (By the way, I was there and was FD Chairman of the club that year. On most bands, we actually ran about 3 W output, and all stations were either battery- or solar-powered.)

30. *False.* If a meteor scatter contact has ever been made on 1.2 GHz, it hasn't been documented.

31. *False.* Invest in a great antenna system and transmission line, then receiver and headphones and maybe a noise reduction system, then comes the lowly transmitter. You'll be glad you spent your hard-earned bucks in this order. Regardless of what is spent where, the most important component of any competitive amateur station is the operator!

32. *False.* Good 'phones make a world of difference. Haven't you ever noticed you can hear more music with a Walkman™ than with a $5,000 home stereo system having huge speakers? The closer the signal source is to your eardrum, the better you'll hear it. Even inexpensive headphones reproduce high and low frequencies better, with less distortion, than loudspeakers costing many times more.

33. *False*, usually. If you're a well-trained and experienced operator with a great, competitive station, then I'd change this to a "true." But for most of us, working DX is easier when locals aren't on the air clogging up the bands.

34. *True.* Biohazards and effects are still not completely understood, but there is lots of documented evidence that they exist and that proximity makes it much worse. If you want to run a kilowatt, please use an antenna that is far away from your operating position! (A good rule of thumb might be: If you can see your antenna, it's probably too close.)

35. *False.* Possible, but unlikely. Most interference including TVI is radiated by your antenna system, which is *supposed* to radiate! Your coax won't radiate very much, whether it's single- or double-shielded. Raising your antenna substantially above the elevation of your neighbors' homes reduces interference better than any other single trick.

36. *False.* Can anyone prove this? I highly doubt it. An effective RF station ground is very difficult to accomplish for most of us. A DC station ground, or "utility" ground, is strongly recommended to prevent the possibility of shock hazard should a short-circuit arise in your equipment, but this has nothing to do with installing ground rods.

37. *False.* It's easy, and if the house is already there and built very strongly, it might be a good idea in some cases. However, your house wall was not designed to hold up a tower. In some cases, it will be disastrous, as in the case of an earthquake that shakes up everything and causes the tower to pull a hole in the wall of your home (I've seen it happen, as recently as January 1994).

38. *False.* Some PVC might be a good RF insulator, but a lot of it is not. You can perform a simple test by trying some out in your microwave oven and putting it on "high" for a minute. If the PVC gets hot, it is NOT a good insulator!

39. *False.* It's silver. And then copper. Gold ranks a lowly third, just above aluminum.

40. *False.* Ideally, coax would be 70 ohms, for minimum loss per unit length. That's why cable TV companies standardized on this higher impedance. However, as a compromise between attenuation, which is lowest at 70 ohms, and power handling (related to current), which is highest at 30 ohms, 50 ohms was settled on back in the late 1940s and has been the two-way radio standard ever since.

41. *False.* They were designed and intended to enhance the range of mobile stations.

42. *True.* Try it.

43. *False.* You're kidding, right? If propagation were inversely proportional to frequency used, we'd all be on 160 meters all the time, wouldn't we?

44. *True.*

45. *False.* RF conducts only on the outermost surface of a conductor ("skin effect") and it doesn't matter whether a conductor is solid or hollow. The larger the surface area (skin area)

of the conductor, the lower its RF resistance will be. The RF skin depth in the amateur spectra is minuscule, with all the current conducted by the outer 1,000th of an inch or so.

46. *True.*

47. *False.* Coax used outdoors should be inspected and tested every year or two, and probably replaced every five or six years. Some "hardline" (solid outer conductor) types will last much longer, and so will conventional, flexible cables used exclusively indoors.

48. *False.* Tuning isn't a problem—it is often a benefit when it comes to reducing spurious emissions. And low-loss wiring isn't required at high voltages: High-voltage wiring (with a healthy insulation) is!

49. *False.* Most quarter-wave whips will handle a kilowatt with ease.

50. *False.* Loss cannot be expressed in watts. It varies with length, frequency, cable constants, altitude, and other variables, but it cannot be expressed in watts no matter how you look at it. It can be expressed as a percentage, or, more commonly, in dB per unit length, e.g., 3 dB per 100 feet at 222 MHz.

So, how'd you *really* do, kiddo?

Although these are relatively easy questions, I have found that 99% of all newcomers, and about 70% of all old-timers, get at least three answers wrong. Tsk, tsk, tsk.

I'll come up with another 50 questions next time and we'll see how you do *then!* 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Code Tapes

73T05 **Genesis 5 wpm code tape** This beginning tape takes you through the 26 letters, 10 numbers and necessary punctuation complete with practice every step of the way. $7.00

73T06 **The Stickler 6 wpm code tape** This is the practice tape for those who survived the 5 wpm tape and it is also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm $7.00

73T13 **Back Breaker 13 wpm code tape** Code groups again at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. $7.00

73T20 **Courageous 20+ wpm code tape** Go for the Extra class license. $5.95

73T25 **Mind Boggler 25+ wpm code tape.** $7.00

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the July issue, we should receive it by April 30. Provide a clear, concise summary of the essential details about your Special Event.

MAR 28

MICHIGAN CITY, IN The annual Michigan City Hamfest and Computer Flea Market will be held at Michigan City High School, 8466 W. Pahs Rd., Michigan City IN, 8 a.m.–2 p.m. CST. Early setup provided for vendors. Admission is $4; children under 12 admitted free with a paid adult. Contact *Ron Stahoviak N9TPC, 5802 N 400 W, Michigan City IN 46360. Tel. (219) 325-9089.*

WEATHERFORD, TX The Amateur Radio Club of Parker County will hold its 10th annual Hamfest at the Weatherford National Guard Armory. VE exams will be given for all classes. Flea Market setup 5 p.m.–9 p.m. Fri., and 6 a.m. Sat. Exams begin at 8 a.m. Talk-in on 147.040 tone 110.9. For pre-registration and vendor info, contact *Elizabeth Hunkele N5ONE, 1507 Old Garner Rd., Weatherford TX 76088. Tel. (817) 594-1700, or fax WA4IXN at (817) 599-6717.*

APR 3–4

ATLANTA, GA The 2nd annual Southeastern VHF Society Technical Conference will be held Fri. and Sat., April 3rd and 4th, in Atlanta GA. Antenna measurements will be done on Friday, starting with 144 MHz and working up in freq., amateur bands only, please. A maximum of two antennas per band per individual may be tested. Please supply a Female N connector or SO-239. Please pre-register. For more info, contact *Antenna Measurements Chairman Dale Baldwin WBØQGH at [wbøqgh@mindspring.com].* Noise Figure Testing will be conducted on Saturday. For more info, contact the *Noise Figure Measurement Co-Chairman Charles Osborne WD4MBK, at [cosborne@pipeline.com];* or *Fred Runkle K4KAZ at [engineer@rightmove.com].* There will be a Friday evening flea market, a Saturday evening banquet, SVHFS auction, and family program. You are invited to visit the Web site at *[www.akorn.net/~ae6e/svhfs].*

LITTLE ROCK, AR The Central Arkansas Radio Emergency Net (CAREN) will hold their All Arkansas Family Hamfest at Sherwood Forest Convention Center, 111 West Maryland Ave., Sherwood AR. Free admission. Talk-in on 146.940(-). For additional info, contact *J.C. Smith N5RXS, (501) 568-7982.*

APR 4

CLAYTON, MO The annual St. Louis County SKYWARN Severe Weather Observation Training Seminar will be held on Saturday. For locations call the *Severe Weather Info Line, (314) 889-2857.* You will get a taped message and additional information. All are welcome, including those from outside the area; no advance registration required. Free parking. SKYWARN Level 1 training is presented in the morning, and classes resume in the afternoon with the SKYWARN Level 2 program. Certification is provided for RACES and SKYWARN, all at no cost. One need not be a ham operator to attend and participate in the program. Please call for additional information.

FREDERICKSBURG, PA The Appalachian Amateur Radio Group will sponsor their 10th Annual Hamfest and Computer Show at Northern Lebanon High School in Fredericksburg. Admission $4; kids under 12 free. Indoor tables $14 each. Tailgating $4. Handicapped access. Setup at 6 a.m. VE exams at 9 a.m. Morning seminars. Reservations for tables are recommended and must be prepaid. Tables not occupied by 9 a.m. are subject to resale. No refunds. Send check for reservations to *AARG, 105 Walnut St., Pine Grove PA 17963. Tel. (717) 345-3780.* Or send to *Lanny Hoffman KD3TS, 337 N. 19th St., Lebanon PA 17046; Tel. (717) 274-2148.*

WATERFORD, CT A ham radio auction, sponsored by the Radio Amateur Society of Norwich, will be held at 10 a.m. at the Waterford Senior Center on Rt. 85. From Hartford, take Rt. 2 south to Rt. 11 to Rt. 85 south. From the shoreline, take Rt. 95 to Rt. 85 north. Talk-in on 146.730(-). Bring your gear to sell (10% commission to RASON). Free admission, free parking. Contact *Tony AA1JN at (860) 859-0162;* or see the RASON Web page at *[www.ims.uconn.edu/~rason].*

APR 5

DELOIT, IA The Denison Repeater Assn. will host an Amateur Radio Swap Meet at the Deloit Community Building, 7 a.m.–2 p.m. Tables and admission will be $2. Talk-in on the KØCNM repeater at 147.090. Reservations for table space may be sent to *John Amdor KD6MXL, 1136 Street F16, Defiance IL 51527.* For more info, E-mail to *KD6MXL at [johnmxl@netins.net].* Check the Web at *[http://www.netins.net/showcase/johnmxl/deloit.html].*

HAMILTON TWP., NJ The Hamcomp '98 Hamfest, sponsored by the Delaware Valley Radio Assn., will be held at Tall Cedars of Lebanon picnic grove on Sawmill Rd. in Hamilton Twp. I-95 North to I-295 S; exit 60A to I-195 E; exit 2 to Yardville; South Broad St. to end, approx. 3.7 miles; left at Yield; next right onto Sawmill Rd. Site is 1.1 miies on the right. Open to buyers at 8 a.m. Open to sellers at 6:30 a.m. Admission $5; non-ham spouses and children admitted free. Tailgating space $10, includes one admission. ARRL table. Free parking. Covered table space $15, includes one table and one admission, some electricity. Advance covered space reservations available. Talk-in on 146.67(-). Contact *Hamcomp '98, DVRA, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240; or E-mail [www.slac.com/w2zq].*

MIDDLETON, WI The Madison Area Repeater Assn., Inc., will hold its 26th annual Madison Swapfest at the John Q. Hammons Trade Center in Middleton. Take Hwy. 12 (the Beltline) west of Madison and exit westbound on Greenway Blvd. Commercial exhibitors and vendors with 6 or more flea market tables will be admitted beginning at 1 a.m.; other fiea market sellers will be admitted at 6 a.m. Doors open to the general public at 8 a.m. New and used electronics gear, from computers to commun- ications equipment, will be on sale. Lots of parts for the elec- tronics hobbyist will also be on hand. Free parking. Hotel accom- modations available at the adjoining Marriott Hotel, as well as at several nearby hotels. Talk-in on the MARA rptr., W9HSY, on 147.75/.15. Admission is $5 per person in advance, $6 at the door. Children under 10 admitted free. 2.5-foot x 6-foot flea market tables are $15 in advance, plus admission. Reserve early. Reservation dead- line is March 28th. For tickets, tables, or spaces, write to *MARA, P.O. Box 8890, Madison WI 53708-8890 USA. Tel. (608) 245-8890.* Visit the Swapfest Web site at *[http://www.cs.wisc.edu/~jeremyc/mara/swapfest/].*

RALEIGH, NC The Raleigh ARS will present its 26th Hamfest/NCS ARRL Convention and Computer Fair in the Jim Graham Bldg. at the NCS Fairgrounds, 8 a.m.–4 p.m. Wheelchair access. ARRL, MARS, APRS, ARES, NTS, QRP, and DX meetings. Admission is $5 in advance, $6 at the door. All activities inside. Tables and booths are available. Free parking; RVs welcome. Hospitality party Sat. night. VE exams contact is *AA4MY at (919) 676-4697.* For pre-registration and dealer inquiries, contact *Wilbur Goss WD4RDT, 4425 Watkins Rd., Raleigh NC 27616. Tel. (919) 266-7883.* Talk-in on 146.04/.64.

APR 10–11

TUPELO, MS The North Mississippi Hamfest & Computer Expo '98 will be sponsored by the Tupelo ARC, Booneville ARC, and Union County

ARC, at Trace Convention Center, intersection of Highway 6 and the Natchez Trace Parkway. VE exams at 9 a.m.; bring original and copy of current license and/or CSCE, and a photo ID; walk-ins accepted. Free parking, no tailgating. Talk-in on 147.38 KC5OBD, rag-chew on 145.49. Admission $5, under 13 admitted free when accompanied by an adult. Tables $20; for reservations write *Jack Ellis KI5QV, Rt. 4, Box 198-B, Tupelo MS 38801; or phone (601) 842-7255. Web site is at [www. tupelofest.org].*

APR 11

BENTONVILLE, AR The Benton County Radio Operators will present a hamfest 8 a.m.–1 p.m. at Bentonville National Guard Armory, SW A and SW 8th Sts. Talk-in on 145.290(-) rptr. Contact *BCRO, P.O. Box 883, Pea Ridge AR 72751.*

APR 18

BELTON, TX "HAM EXPO—the Spring 'Fest" will be sponsored by the Temple ARC. From Interstate 35, take Exit 292 to the Bell County Expo Center. Admission $1. Handicap accessible. Huge indoor tailgate arena; spaces $10 (only at the door). Tables available at an additional $10 each. Tailgate setup begins at 5:30 a.m. Free electricity. Doors open at 7 a.m. Talk-in on 146.820(-) MHz, PL 123.0 Hz. Commercial vendor space with tables, $20 ea. (Sat. setup); or $25 ea. for Fri. night early setup (reserve by Apr. 10th). Free electricity. Contact *Temple Amateur Radio Club, P.O. Box 4511, Temple TX 76505.* Deliveries to: *1802 S. 13th St., Temple TX 76504. Phone Mike LeFan WA5EQQ at (254) 773-3590; E-mail [hamexpo@vvm. com]. Expo Web page at [http:// www.tarc.org].*

JOPLIN, MO The Joplin ARC Hamfest 98 will be held at The John Q. Hammons Convention Center, 3615 Range Line Rd., Joplin MO. Setup Fri. 6 p.m.–10 p.m., and Sat. at 6 a.m. VE exam registration at 10 a.m., with exams starting at 11 a.m. Contact *Andy Gabbert KAØTUD, E-mail [agabbert@hotmail.com] or Jim Johannes NØZSQ, 1930 E. 34th St., Joplin MO 64804; E-mail [jjohannes@clandjop.com].*

APR 19

CEDAR HILL, MO The Jefferson County ARC Spring Hamfest and Computer Show will be held at the Elks Lodge, Highway 30 and BB, 20 miles west of Interstate 270. Doors open at 7 a.m.–1 p.m. Flea market setup Sun., 5 a.m. Inside table $10; with electric $15 (limited). Tailgate space $5. VE exams at 9 a.m. Talk-in on 147.075/.105. For info please contact *Jim KAØWXN, at (314) 296-3473.* Send paid reservations to *JCARC c/o Jim Autery KAØWXN, 3596 Reuter Acres, Imperial MO 63052-1034.*

SHAKOPEE, MN Canterbury Park will be the location for "Smartsfest 98 Hobby Electronics Show." This event is being sponsored by the Southwest Metro Amateur Radio Transmitting Society, Inc. Fleamarket setup Sun. morning at 7 a.m. Tables available. Electricity available. Separate entrance for sellers. Free parking. VE exams. Advance tickets $4 ea., $5 at the door. For more info write or call *SMARTS Inc. P.O. Box 144, Chaska MN 55318.* Call *Helen at (612) 361-6782* regarding flea market or advance tickets.

STICKNEY, IL The DuPage ARC will hold their Hamfest and Computer Show at the Hawthorne Race Course, 3500 South Cicero Ave., Stickney IL, 8 a.m.–2 p.m. Commercial dealers can set up indoors on Sat., 3 p.m.–6 p.m. Commercial and flea market setup on Sun. after 6 a.m. Tickets $4 in advance, $5 at the door. Free parking. For table availability call (630) 985-9256. Advance tickets $4 each until March 30th. Send check payable to "DARC," with a #10 business-size SASE to *Hamfest 98, 7511 Walnut Ave., Woodridge IL 60517-2818.*

APR 25

SONOMA, CA The Valley of the Moon ARC, W6AJF, will hold its annual ARRL Hamfest 8 a.m.–noon at the Sonoma Valley Veterans' Memorial Building, 126 First Street West, in Sonoma. Follow Highway 12. Admission is free; bring the entire family. Walk-in VE exams; registration starts at 9 a.m. Testing for all classes begins at 10 a.m. There will be an indoor and outdoor electronics swap meet with setup starting at 7 a.m.; spaces, $10. A full breakfast will be served 8 a.m.–10 a.m. for $5. Pancake-only breakfast for $3.50. Forums will include an operating QRP station and display of home-built equip., beginners' DF hunt, and more. VOMARC will participate in the QRP-to-the-Field contest, which will run during the hamfest. Guest ops are cordially invited to sit in and take a turn operating the club station. For a map and printed directions to the hamfest, send a business-size SASE to *VOMARC, 358 Patten St., Sonoma CA 95476.* Talk-in will be on 145.35(-600) PL 88.5. For more info call *Darrel WD6BOR at (707) 996-4494.*

WEST GREENWICH, RI The Fidelity ARC and Washington County ARC will hold their 2nd annual hamfest 9 a.m.–4 p.m., on Rt. 3 in West Greenwich RI. Directions: From northbound I-95; take exit 5A; turn left at Rt. 3; go approx. 2 miles. From southbound I-95 take exit 6, turn left onto Rt. 3; go approx. 4 miles. Next to the West Greenwich Fire Station. Admission $1. 6 ft. spaces, $6 ea.; contact *Everett Lovenbury N1VEZ, 232 Carolina Nooseneck Rd., Wyoming RI 02898-1172; tel. (401) 539-1107; E-mail [N1VEZ@ juno.com], or Bill May WA1WM, 20 Montana Ave., Coventry RI 02816-5510; tel. (401) 822-0520; E-mail [WA1WM@juno.com].* Setup starts at 7 a.m. VE exams at 12 p.m. (walk-ins). All classes bring ID and any CSCEs that might apply.

APR 26

ARTHUR, IL The Moultrie AR Klub is hosting their 36th annual hamfest 8 a.m.–1 p.m. at the Moultrie/Douglas County Fairgrounds on the south side of Arthur. Admission $4 per person over 14 years old. There will be a forum tent with something going

on every hour. Flea market tables (limited) are $10 per table paid in advance. For table info and reservations, write to *M.A.R.K., P.O. Box 91, Lovington IL 61937.* Or call for info during the day, *(217) 543-2178* and eves. at *(217) 873-5287.* No VE exams this year.

CANFIELD, OH The Twenty Over Nine Radio Club Inc. will sponsor their 14th annual Hamfest Computer/Electronics Flea Market at Canfield Fairgrounds, Rt. 46, Canfield OH, 8 a.m.–3 p.m. Handicapped parking and facilities available. Gate admission $5, under 12 years admitted free with an adult. Outdoor flea market space is free with admission. Dealer/flea market setup begins at 6:30 a.m. Inside tables $10 per table, gate admission not included. Inside tables guaranteed until 9 a.m. with reservation/fee in advance. Others on a first-come, first-served basis. Uniformed and plainclothes security will be present. Alcoholic beverages, firearms, and questionable or immoral material are strictly prohibited on the fairgrounds property. Mobile check-in and directions until 1 p.m. on 147.315(+) or 443.225(+); alt. 145.275(-). For further info contact *Sharon Spencer, 424 Peffer St., Niles OH 44446, tel. (330) 544-3666; or Dave Mellot, 2895 Penny Lane, Youngstown OH 44515, tel. (330) 793-0816; or Don Stoddard N8LNE, 42 S. Whitney Ave., Youngstown OH 44509, tel. (330) 793-7072.* Mail registration with an SASE and check/money order payable to *20/9 Amateur Radio Club Inc., 42 S. Whitney Ave., Youngstown OH 44509* no later than April 15th.

NEW CASTLE, DE The Penn-Del ARC will hold their annual hamfest and host the 1998 ARRL Delaware State Convention 9 a.m.–3 p.m. at the Nur Temple on Route 13 North in New Castle DE, 1/4 mile north of the Route 13 and 40 intersection. Admission $5 at the door, no advance. Under 12 years free. Tables by reservation only with payment to *Penn-Del Hamfest 98, P.O. Box 1964, Boothwyn PA 19061.* Tables $15 with electricity or $10 without, includes vendor admission ticket. Setup at 6 a.m. Tailgating is $10 per space on a first-come, first-serve basis. Features: certified SKYWARN spotter training class; ARRL and club leaders forum; special guest speaker Ed Hare W1RFI from ARRL headquarters will present a seminar on the new FCC RF exposure regulations. He will also be available to assist with the completion of evaluation forms. For more info contact *Hal Fronts KA3TWG at (302) 793-1080, or E-mail [hfrantz@magpage.com].* Also, find up-to-the-minute info/lodging and vendor forms at *[http://www.magpage.com/penndel].*

MAY 2

CADILLAC, MI The Wexaukee ARC will hold their annual hamfest 8 a.m.–1 p.m. at the Cadillac Middle School in Cadillac MI. VE exams for all classes at 1 p.m. Admission $5; 8 ft. table $6. Setup at 6 a.m., table holders only. Talk-in on 146.98 rptr. Contact *Dan KE8KU, Wexaukee ARC, P.O. Box 163, Cadillac MI 49601. Tel. (616) 775-0998; E-mail [ke8kudan@juno.com].*

MAY 2–3

ABILENE, TX The Key City ARC will sponsor a hamfest at the Abilene Civic Center from 8 a.m.–5 p.m. Sat., and 9 a.m.–2 p.m. Sun. Free parking. VE exams. Wheelchair access. Tables $6 each. Pre-registration $7 (must be received by Apr. 28th), $8 at the door. Talk-in on 146.160/.760. For reservations and info, contact *Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889.*

MAY 3

YONKERS, NY The Metro 70 cm Network will hold another Giant Electronic Flea Market at Lincoln High School, Kneeland Ave., Yonkers NY, 9 a.m.–3 p.m., rain or shine. Free parking. No tailgating. Indoor flea market only. VE exams. Vendors: $19 first table, $15 each add'l table. All tables 30" x 5', or bring your own tables at $14 for a 6 ft. space. At the door $25 each table, $20 for a 6 ft. space. Full payment is due with registration. Mail reservation payments to *Metro 70cm Network, 53 Hayward St., Yonkers NY 10704.* Spaces will not be held past 9 a.m. No refunds unless prior notice of cancellation has been received 72 hrs in advance. Donation $6, kids under 12 free. Table setups at 7 a.m. Free coffee, door prizes, grand prize drawing at 1:00 p.m. For registration, or vendors' or buyers' information, call *Otto Supliski WB2SLQ, (914) 969-1053.* Talk-in on 449.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 MHz; and 443.350 MHz PL 156.7.

MAY 9

MANITOWOC, WI The Lakeshore Hamfest, Electronics & Computer Swapfest will open its doors at 8 a.m. at the Manitowoc County Expo Center, intersection of Hwys 42-151 and I-43 on County Hwy. Rd. Fri. night setup for vendors until 10 p.m.; also starting at 6 a.m. Sat. morning. Accommodations for vendor drive-ins. Advance tickets $3, $4 at the door. Reserved 8 ft. tables $6 each. Electric outlets $5 each. VE exams for all classes at Silver Lake College (Hwy. 151); test registration closes at 9 a.m. DXCC field checking at the expo. For info call *Glenn, (920) 684-7096, any time,* or *Red, (920) 684-9097, days.* Talk-in on 146.61(-) or 147.03(+). Send reservation payments with an SASE to *Mancorad Radio Club, P.O. Box 204, Manitowoc WI 54221-0204.*

MAY 14–17

DAYTON, OH The QRP Amateur Radio Club International will present their "Four Days in May" 1998 Conference at the 1998 Dayton hamvention®. Amateur radio QRP presentations, workshops, and demonstrations will be the focus of the all-day Thursday QRP Symposium to be held at QRP ARCI headquarters, the Days Inn Dayton South. Registration is $10 if prepaid by May 1st and $12 after that or at the door. "At the door" registration may be limited by sellout. Registration will cover a full day of QRP Symposium activities, coffee, Symposium bag stuffers and a complimentary copy of the FDIM 98 QRP Symposium Proceedings. Make payment to QRP ARCI, and send with an SASE by May 1st to *Cam Bailey KT3A, FDIM Symposium Registration, P.O. Box 173, Mt. Wolf PA 17347.* E-mail queries to *[kt3a@juno.com].* The QRP-ARCI Awards Banquet, Fri. May 15th, is being hosted by FDIM Banquet Chairperson Scott Rosenfeld NF3I. Please send an SASE and your $22 banquet ticket fee (US check, money order, international money order) made payable to QRP ARCI (by May 1st) to *Scott Rosenfeld NF3I, QRP ARCI Banquet Tickets, 4015 Sparrow House Lane, Burtonsville MD 20866-1333.* E-mail queries for more info to *[ham@w3eax.umd.edu].* The FDIM QRP Vendor Social will be held Fri. evening May 15th, with Jim Stafford W4QO, QRP ARCI VP, as the host. For registration info please contact *Jim at 11395 West Rd., Roswell GA 30075, or E-mail [w4qo@amsat.org].* The Days Inn Dayton South will be the 1998 FDIM QRP headquarters and a special block of rooms has been secured. Please contact *Hank Kohl K8DD, 1640 Henry St., Port Huron MI 48060; E-mail [k8dd@tir.com]* regarding availability of rooms. QRP Symposium presenters, please submit your QRP technical manuscripts to *FDIM 98 Technical Paper Chairperson Ken Evans W4DU, 848 Valbrook Court, Lilburn GA 30047; or E-mail [w4du@bellsouth.net].*

JUL 26

HONOLULU, HI In celebration of their third wedding anniversary, a grand Ham-Boree is being planned by Gordon Crowhurst G4ZPY and Brenda in the form of a big get-together of hams and their partners for an evening meal in Honolulu. They would like to put a face to a callsign, a face to a name, of their many friends and acquaintances all over the world. For those who are interested, there are a lot of nearby mountains for DXing on the Pacific Rim. For more info contact *G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough, Ormskirk, L40 7TG England. Tel./FAX (44) (0)1704-894299* anytime until 2300, but not between the hours of 1600–1830 local time. Everyone must make their own holiday arrangements themselves and pay for their evening meal. Please R.S.V.P. so that a suitable location may be arranged for the get-together.

Continued on page 85

Hamtronics' CC432-5 Receive Converter Kit

Straightforward building, modest price.

Larry Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03455

One of the main attractions of amateur radio is the fact that it's a multitude of sub-hobbies contained within a single hobby. Most hams start out chasing DX or doing two-meter work, but it isn't long before they move off to public service, satellites, moonbounce, construction—whatever catches their attention. This fact makes for an exciting hobby, and explains why it's fairly easy to remain interested in ham radio for your whole lifetime.

Of course, this wonderful diversity has its downside. How do you pay for all that stuff? Many a ham has found himself feeling like a small child, clutching a nickel in a candy store. So many choices, so little funds. On first glance this seems to fly in the face of the classic ham stereotype—frugal to a fault. How is it that hams can be so notoriously cheap if they have to buy a brand new rig every time they decide to explore a new segment of the hobby?

As you might imagine, hams have already figured a way out of this dilemma. The concept is fairly simple. Imagine yourself going out and buying a new HF rig. About a year later you buy a 220 MHz transceiver, and then you pick up a 440 MHz rig. You have all three of them lined up on a shelf in your ham shack. As you sit there looking at them a couple of things become obvious.

First, you note that you can only talk on one of them at a time. Second, you can see that the three radios are pretty similar. They all have frequency displays, volume controls, speakers, microphones, and other components in common. As a matter of fact, you see that the 220 MHz and 440 MHz rigs are practically identical—they just work on different frequencies. The conclusion is simple—you just paid for three sets of these "common controls" when you really only needed one.

Attacking the problem from the other direction, suppose that you didn't quite have the funds to get that 440 MHz rig. What if you could have just purchased the part you needed—the frequency stuff—and used the common stuff from one of the radios you already had?

So, what's a converter?

Converters have been used for years, mainly to allow a ham to take an existing rig (usually 10 meters) and put a box in front of it that converts the receive and transmit frequencies to another band (usually VHF or UHF). This gives the user the same functionality of the HF radio (memories, scanning, etc.) but simply translates the frequencies to a new band.

The converter concept has been used for many years as an external add-on, and also as a design concept in some receivers. More recently some manufacturers have released mobiles that allow different frequency modules to be used with the same control head—a slight twist on the original converter concept.

The CC432-5 by Hamtronics is one of several receiving converters built by this manufacturer. The model chosen depends on the frequency of operation desired. For instance, the CC432-5 accepts an input range of 435–437 MHz, and outputs a signal from 28–30 MHz. If you already have a two-meter transceiver, you can order the CC432-4, which accepts an input from 432–436 MHz, and creates an output signal from 144–48 MHz. If you are primarily interested in ATV you can get the CC432-9. This unit accepts 439.25, and translates it to 61.25 MHz (channel 3). If UHF is not your cup of tea, Hamtronics

Photo A. The Hamtronics CC432-5 Receive Converter.

offers a line of VHF receive and transmit converters as well.

How does it work?

The theory of operation of the converter is fairly simple. A converter is simply an extra mixer and local oscillator placed ahead of the existing radio. In the case of the CC432-5, the local oscillator in the converter is running at 407 MHz. Signals enter the converter in the desired frequency band, and are offset by the value of the mixer. For instance, a signal entering the converter at 436.5 MHz will be mixed with the 407 MHz local oscillator, producing a difference frequency of 29.5 MHz, which can be received by the 10-meter rig attached to the converter.

If you remember your superheterodyne receiver basics you'll recall that the sum frequency is produced as well as the difference frequency. You'll also see that any number of input frequencies can be entering the converter at a given time. Most of these signals are unwanted, and are dealt with by the use of input and output filters. The CC432-5 has a built-in GaAsFET RF amplifier which is tied to a mixer via a triple-tuned circuit. This provides selectivity by allowing only the desired signal band to reach the mixer. The output of the mixer passes through an over-coupled double-tuned tank circuit. This circuit selects a band that corresponds only to the difference frequencies—the sum and the original two inputs to the mixer are effectively filtered out. (The over-coupling produces a circuit with a wider bandwidth, so it won't be necessary to retune any of the circuitry over the entire range of operation.)

The local oscillator input to the mixer is actually the result of a chain of three triplers. The crystal operates in the 14–6 MHz range, depending on model, and the third harmonic is passed through two more tripler circuits to produce the desired injection frequency. Once again, double-tuned circuits are used to ensure that the injection frequency is pure.

As with any receiver, the local oscillator is actually a very low powered transmitter. It is always important to make sure that the oscillator frequency stays where it is needed, and doesn't leak out into the outside world. For instance, if the 407 MHz injection frequency were allowed to travel back out the converter input, it could interfere with licensed users in the 407 MHz region. This situation is prevented by the use of the double-tuned circuits mentioned earlier, the use of a preamp stage, and also by the quality of components used by Hamtronics. Bypass capacitors and ferrite beads are used to decouple the stages. A high quality PC board with a ground plane aids in the shielding. Additional shielding is used to prevent the RF amplifier stage from picking up any radiation from the mixer section. Power is passed to the unit via a feedthrough capacitor. All of these minor enhancements join together to make the CC432 a very stable and interference-free converter.

Putting it all together

Construction of the CC432-5 was fairly straightforward, and should be no trouble to anyone with a moderate amount of kit-building experience (two or three simple kits). The kit uses quite a few surface mount devices (SMDs) but only in the form of chip caps and resistors, which are quite easy to solder in.

The kit uses two FETs for the RF amplifier and the mixer, as well as three standard 2N3904s for the injection multiplier chain. The FETs have the potential for static damage, so a brief list of precautions is spelled out in the instructions.

The Hamtronics manual is typical of their other products—descriptive enough to do the job, but not insulting. For instance, the precautions about static are followed by a fairly detailed description on how to mount the FETs. Attention is given to orientation, getting the right FET in the right slot, avoiding excessive heat, and bending the leads the right way. On the other hand, you're then directed to "Install the six small variable ceramic capacitors and the one piston variable capacitor, orienting them as shown." This is followed by tips on how to best install the SMD chip caps and resistors, probably with the assumption that most builders haven't used too many SMDs before.

Lining it up

Alignment of the converter is simple, and can be done with a DC voltmeter. A signal source is required, which can be a signal generator or even a strong off-the-air signal. The alignment consists mainly of peaking the coils in the injection chain, followed by a tune-up of the last multiplier, mixer, and RF amp for maximum signal passed to the receiver. The crystal is "netted" as a final step, which makes sure your output signal will exactly follow the converter input (minus the offset).

Although no special equipment is needed for alignment, a 0.060-inch square alignment tool is needed for all six variable inductors. The proper tool must be used with these slugs—they are quite prone to cracking if a substitute tool is used—for instance, a straight-blade alignment tool jammed in on a diagonal (trust me on this one). This tool is becoming more common in amateur, commercial, and consumer electronics. If you don't have one already you can order one from Hamtronics.

Getting it on the air

Operation of the converter is simple, since there are no controls! You already know how to use your 10-meter transceiver, so once you hook up the converter you'll know how to use your 432 MHz receiver. One point to remember is that the CC432-5 is a receive converter only—a separate unit is required to convert the transmitter side of the transceiver. This is normally accomplished

with separate outputs from the HF rig, or a TR relay setup if you're using a low-cost 10-meter rig. When first trying out the receive converter, however, keep in mind that it won't enjoy having any power accidentally blasted into the mixer—the results could be fatal. My initial tests were performed with the microphone removed from the 10-meter rig. That way I would be unable to sit on the mike and accidentally key the transceiver into the converter, despite my best efforts to goof things up.

The unit I built tested out fine on the bench, and I even had time to drive up on one of our local mountains during a recent VHF/UHF contest and "read the mail." This was very successful as I heard lots of stations—but pretty frustrating, since I hadn't yet built my transmit converter! (In retrospect, it might make more sense to build the transmit converter first. That way you won't have anything to listen to while you're working on the receiver, which could be less distracting than the other way around!)

An aesthetic viewpoint

My single criticism of the CC432-5 concerns the power connector. As mentioned earlier, power is fed to the unit via a feedthrough capacitor. This prevents any RF that might have found its way onto a power lead from getting back out of the unit where it could interfere with another service. A good idea, but the only way to attach to this lead is to solder a wire directly to it. The feedthrough is located dead center on the front of the unit between the input and output BNC connectors, and having a power lead soldered to the cap at this point is not the most appealing solution from an aesthetic standpoint. Of course, this is probably the only way to make a true RF-tight container—as soon as you punch a hole for a Molex™ connector you violate the integrity of the enclosure. In addition, the box is most likely going to be used tucked behind a transceiver somewhere, rather than displayed on a shelf. Still, if this connection (or all three, for that matter) could exit the box on the rear it would make for a nicer-looking station.

The Hamtronics CC432 converters present an economical method for expanding your ham horizons. Inexpensive and easy to build, they allow you to make the jump to other bands and other segments of the hobby. The quality of the units is outstanding—the finished board has the look and feel of a piece of commercial gear, rather than an amateur device. Any ham should have no trouble getting these kits on the air, and they range from $49 for the kit alone, to $79 for the kit with case, to $99 wired-and-tested in a case.

Hamtronics converters are available from Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535. E-mail: [jv@hamtronics.com]. Web site: [www.hamtronics.com]. You can request a free catalog or view the entire catalog on their Web site.

Joy's "Loud Enough" Metronome, Part 1

Another fun project from Mr. Gizmo.

Evert Fruitman W7RXV
2808 West Rancho Drive
Phoenix AZ 85017-2646
[fruitman@asuchm.la.asu.edu]

Several years ago, my daughter's music teacher sent us on our way with what she thought was just an offhand request: "Oh ... and please bring a metronome to your daughter's music lesson next week. Thank you ... "

A quick look at a music supply catalog showed metronomes ranging in price from $20 to almost $200. That included the older-style mechanical metronomes with the upside-down pendulums. I rarely buy something I can build, so once I'd decided that one week gave me enough time to make a metronome, I was off and running ... or should I say off and ticking?

Some of the microprocessor-based units can put an accent on whatever beat you want, as well as let you pick practically any number of beats per minute. However, I felt that it would be too inconvenient trying to hold one of those to one ear and play the flute or the piano at the same time. You have to hear the precision pulses in order to use them.

Also, the pulses have a somewhat musical sound, something like a note that got cut off in midstream. That has drawn unfavorable comment from several musicians I've talked to, including those who, for lack of something better, use one of those shirt-pocket-sized units. Of course, their relatively small size is a convenience, and sometimes a consideration.

Computerized cure?

The children had already complained that with other electronic metronomes they could not hear over the piano, even with the metronome sitting on top of the piano right in front of them.

A quick but temporary fix for that came in the form of a BASIC program fed into an old computer which drove an audio amplifier. That gave the speaker enough volume, but it was somewhat inconvenient to hook up. Wires all over the music room and questions about how to get the program running made me look for a better answer.

Digital devices

Countdown chips, dividers, and amplifiers could be combined in a circuit that would give a louder metronome with adequate volume, but the circuit seemed too complex for what we wanted. If we were going to do all of that, why not just go buy one of the credit-card-sized wonders and hang it on an amplifier? Then I remembered some circuits that I had used once before. They worked, but with some limitations. It seemed that with some modification, one of those circuits would meet this need.

Early transistorized systems

In a 1964 edition of their *Transistor Manual*, General Electric published a couple of metronome circuits. **Figs. 1** and **2** show them in slightly modified form.

The UJT (unijunction transistor) circuit, **Fig. 1**, looked good with its adjustments, but a quick test at the workbench showed it a bit short on volume. A 22.5-volt battery gave its own problems. 15 penlight cells or three nine-volt batteries didn't appeal to me, especially since they did not make it that much louder. Besides that,

I usually have loose transistors in the spare parts box, but it would take extra effort to find a UJT—another trip to the store, and they're not all that easy to find; several years ago, some of the major semiconductor manufacturers quit making them.

The complementary circuit, **Fig. 2**, gave more volume—but try to find a small three- to four-ohm speaker today. Without a good supply of output transistors, it became impractical trying to use the circuit with an eight-ohm or higher-resistance speaker. Sometimes it worked for a while, and sometimes I had to change the output transistor. Still, the circuit had enough good points to cause me to give it a closer look.

Hang-ups

When the circuit hung up due to a wrong-value R, C, or speaker, then the output transistor, Q2, would burn out. The original circuit used germanium transistors and a three- to four-ohm speaker. The circuit worked as originally published. However, when this circuit hangs up, it causes the output transistor to exceed its power/current ratings.

Substituting heavier-duty silicon transistors seemed like a good starting point. When the circuit misfired, though, it still got Q2 hot under the collector. A little circuit analysis gave some insight into the problem and how to get around it.

In **Fig. 2**, turning on the power starts the capacitor charging through the speaker, R4, and R5. When the voltage at the junction of the speed control, the capacitor, and the base reaches about 0.6 volts, Q1 turns on. It starts conducting current through its emitter-collector circuit and the emitter-base junction of Q2.

Of course, running current through the emitter-base junction of Q2 turns it on. Q2 starts conducting current through the circuit consisting of its emitter-collector and the speaker. Since the collector of Q2 reaches essentially the same potential as its emitter, C2 discharges, thereby dropping the base voltage of Q1 below 0.6 volts and turning off Q1 and Q2.

With the capacitor discharged and the transistors off, the capacitor starts charging again, starting a new cycle: Q1 turns on, Q2 turns on, the speaker gets the full battery voltage for a few milliseconds, and the timing capacitor gets discharged.

Due to regenerative action, positive feedback, the turn-on of Q1, Q2, and the discharge of C1 all take place in milliseconds. Typically, the pulse lasts about four milliseconds (0.004). An oscilloscope shows that during much of that time, the high side of the speaker, the collector of Q2, reaches the applied voltage.

That makes Q2 an efficient switch. For a short time, it has tied the battery directly across the load. That also explains why this circuit can cook a transistor in the event of a malfunction in which Q2 stays turned on. It also points up the need for a big capacitor across Q2 and the speaker. C3 can deliver the high current needed to pulse the speaker.

With a 4.5-V battery and a three- to four-ohm speaker, the peak current can exceed one amp. I have measured it—it does reach 1.1–1.5 A under these conditions. When the battery starts getting tired, the circuit does peculiar

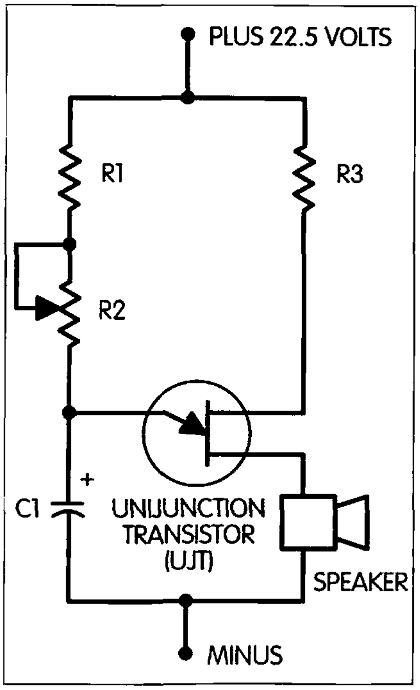


*Fig. 1. This simple UJT metronome will work with a wide range of speakers but lacks volume. Additionally, it needs a higher voltage battery for best results. By putting the amplifier from **Fig. 3** on it, you may drop the battery voltage down to 9 V and run both parts on the same battery. Adding the power amplifier of **Fig. 3** gives more volume, but still this setup is not as loud as the system shown in **Fig. 4**.*

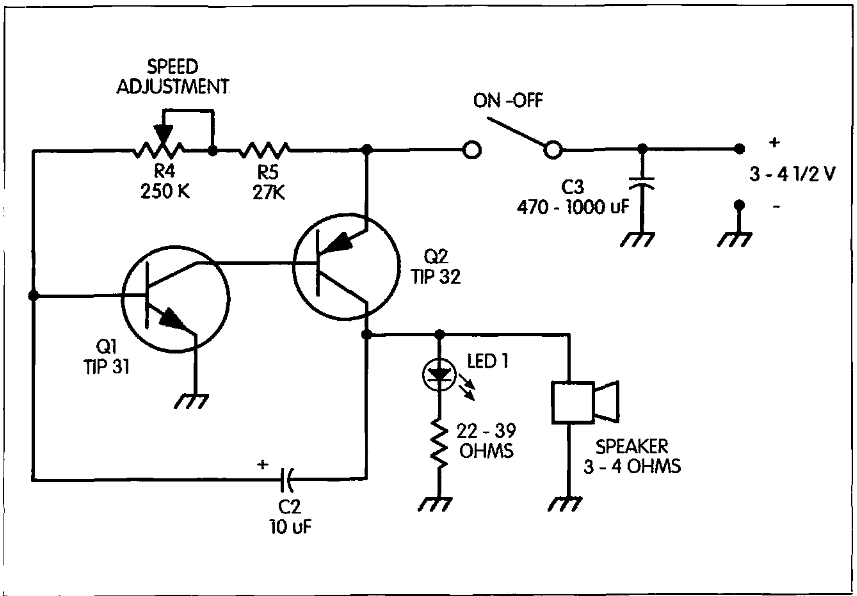


*Fig. 2. This basic metronome works best with a 3–4 ohm speaker and 3–4 V. Although reliable, it lacks the volume needed for a player to hear it over the sound of many common solo instruments. The amplified version, shown in **Fig. 3**, gives a loud enough* tock *sound. C3 must go on the battery side of the on/off switch. Placing it on the instrument side causes a slow fade-out of the sound, with the pulses changing speed as the sound fades.*

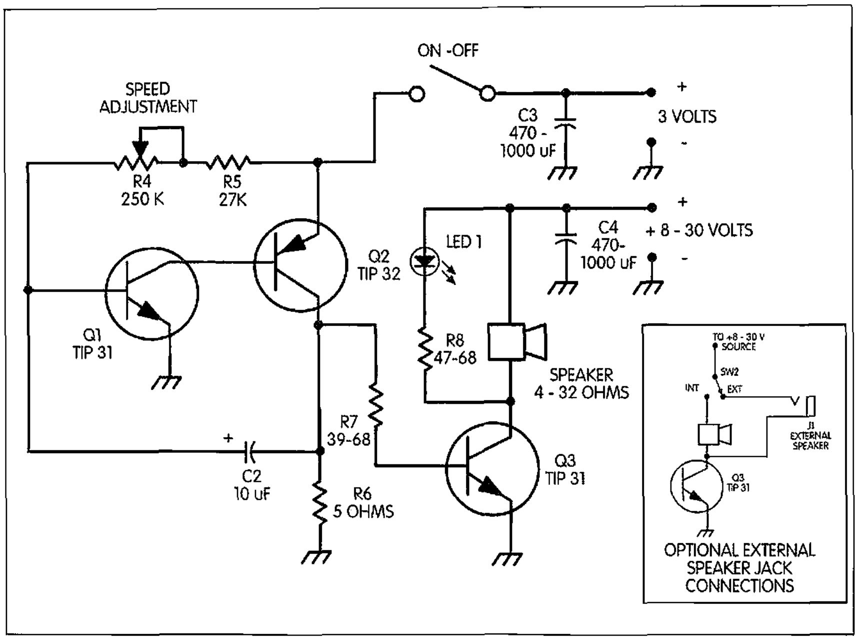


Fig. 3. Amplified metronome using complementary pair. Loud enough with external speaker; sometimes loud enough with just internal speaker. Smaller circuit shows one way to add the option of internal/external speaker selection. Instead of the switch, you could buy a closed-circuit jack for J1. Some people find the switch less confusing than the closed-circuit jack and much more reliable. With the addition of R6, R7, and Q3, you can use almost any available speaker and raise the power level by use of a higher-voltage battery. Since Q3 draws power only when it gets a pulse from Q2, you may use a simple on/off switch on just the first stage. Sometimes Q1 and Q2 will not operate properly with more than 3-1/2 V.

things. Do use C3. This circuit works well with three to four volts and a nominal four-ohm speaker. Most of the time it will work with as much as five volts if you keep the resistance in the collector of Q2 around four to five ohms; sometimes, it wants less resistance.

Exception to the rule

I made several of these metronomes. They used a five-volt regulator and five ohms for the collector load of Q2. All but one of them worked as expected. They delivered a nominal four-millisecond pulse and from 40 to 240 or more beats per minute. One of those metronomes hung up. It turned on Q2, which stayed turned on, until I interrupted the power connection. The heavy-duty silicon transistors can withstand the extra current caused by this overload condition. I checked everything, but I lost that round. I wound up putting another resistor across the five ohms from the collector of Q2 to common. The total resistance equals about three ohms. The pulse runs about one-tenth as long as the other units. Since then, it has kept good time.

A fix

Dropping the voltage on that unit to three volts, with or without the extra resistor, the circuit never missed another beat. That unit went together with the extra resistor. The next metronome went together with a five-volt regulator followed by a three-volt regulator—see **Fig. 5(a).** You could save the time and trouble of the second regulator circuit by using an adjustable regulator, the LM317, as shown in **Fig. 5(c). Photo A** shows an etched circuit board with the two regulators. Since I wanted to save myself a trip to the store, I opted for the extra transistors. The simple two-transistor regulator cannot regulate well enough by itself to keep the three volts as stable as needed. So you need either the five-volt preregulator or the LM317.

Parts List for Fig. 3

R4	250 k pot (500 k with 470 k across will work but crowd high end)
R5	27 k 1/4 W (same for all resistors)
R6	4.7 Ω or 2x10 Ω in parallel
R7	39–68 Ω
R8	47–68 Ω
C2	10 µF 6 V tantalum *272-1436A 10/16
C3	470–1000 µF 6V *272-958 1000/16
C4	470–1000 µF 25 V (if battery no more than 22 V; if close to 28 V, use 35 V cap)
Q1, Q3	TIP31 NPN transistor *276-2017
Q2	TIP42 PNP transistor (TIP32 OK) *276-2027
LED1	red: *276-087 green: *276-069 use 470–680Ω for R8
J1	open circuit mini phone jack *276-251C
SW1	SPST toggle or slide
SW2	SPDT toggle or slide

Speaker: Midland 21-392, junk box or Radio Shack 2-1/2 inch

Box : 3x5 file box or Radio Shack 270-223

Batteries: six AA or three 9 V (typically one or two 9 V will do)

*Radio Shack part number

*Table 1. Parts list for **Fig. 3**.*

Three-volt regulator

Fig. 5(a) shows the simple three-volt regulator. A 7805 regulator delivers five volts to the input of the three-volt regulator. The 4700-ohm resistor, R9, limits the current through the diode string, LED2, LED3, and D1, to a little less than 400 microamps: 0.4 milliamps.

The diode string will maintain a relatively constant voltage across the base of Q4. With low to medium current through them, the LEDs will have a relatively stable voltage across them.

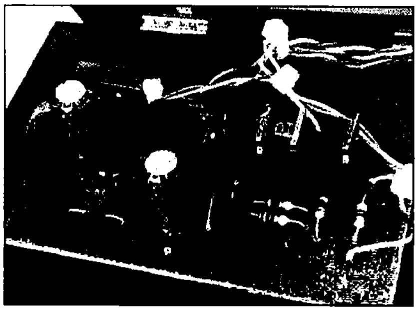


Photo A. Etched (taped) board in basic, bare-bones, blue-box metronome. Lower left corner: D1, LED2, LED3. Above that: R9 (4700 ohms). Top left: C4, 7805 regulator. Middle: Q4 (in back of C3), Q5, Q1, C2, Q2, Q3. Lower right: 47-ohm resistor to LED1.

The voltage drop across the LEDs drifts less with temperature and current changes than it will across a silicon power diode.

The voltage across the LEDs will run from around 1.2 to 1.8 V each. The drop depends upon the internal construction of the individual LED. The current through the LED will have some effect on the voltage drop. The total voltage drop across the diode string is just over four volts. You could replace the diode string with a 4.3–4.6-V zener diode.

The voltage from the diode string feeds the base of Q4. Q4 and Q5 make a Darlington pair. In this case, they are connected as an emitter follower. That applies the input voltage, minus the voltage drop in the two emitter-base junctions, to the load. The load is the complementary pair, Q1 and Q2.

Regulation

Since Q4 and Q5 have no way to sense changes in output voltage, they have no feedback from output to input and they cannot make the changes needed to maintain a constant output voltage when the input voltage makes a large change. An emitter follower like this will hold a relatively steady output voltage, but for this application it needs the preregulator in the form of the 7805.

Of course, you can avoid all of this fun by using the LM317, as in **Fig. 5(c)**. Just set it to three to four volts and you are done with the power supply for the heart of your metronome, the complementary pair.

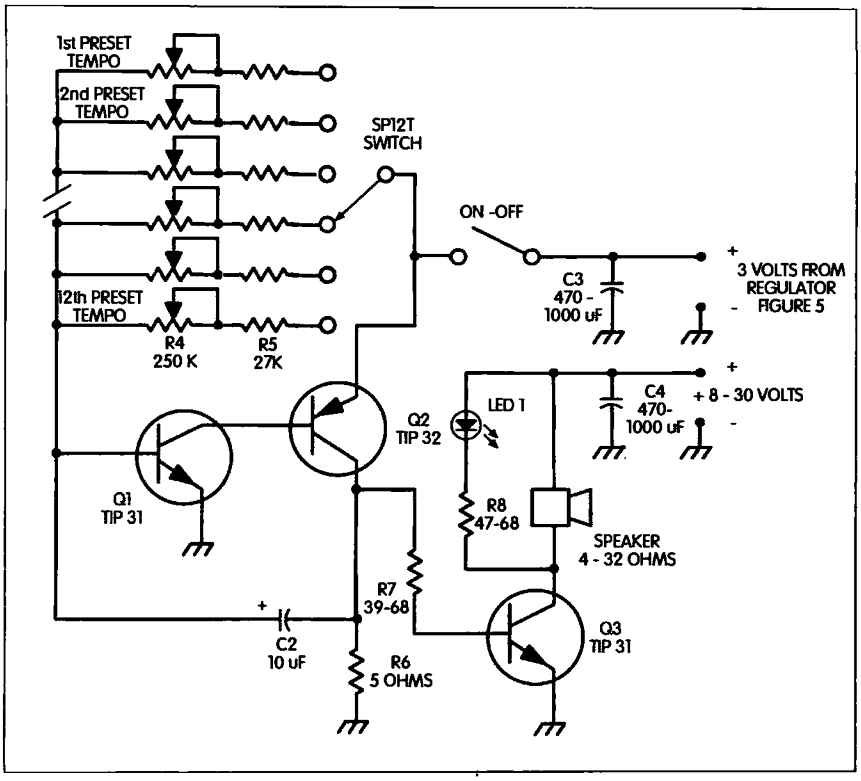


*Fig. 3(a). Amplified metronome. Same as **Fig. 3**, but shows how to add presets. For simplicity, only six of twelve switch positions shown.*

Parts List and Presets for Fig. 3(a)

For the presets, add these parts to the list for Fig. 3:		
Switch	SP12T	8 presets plus variable, 11 presets possible
Trimmer Pots	Fixed	Beats/Minute (adjust trimmer as needed)
15 k	270 k	40
15 k	180 k	60
50 k	100 k	72 (or 73)
50 k	100 k	84
50 k	100 k	96
20 k	82 k	112
30 k	82 k	120
20 k	68 k	132

*Table 2. Parts list and presets for **Fig. 3(a)**. If you compare these values to those listed for the deluxe version, there may seem to be some inconsistencies. Chalk that up to the variations in the size of the available trimpots used in this model.*

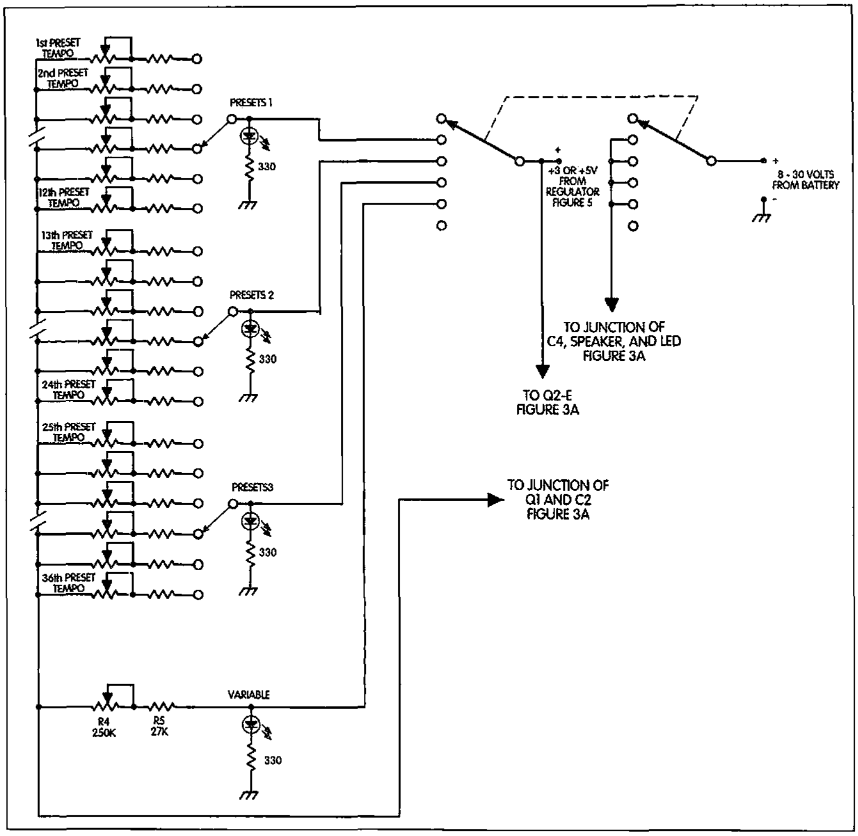


Fig. 3(b). Deluxe configuration with 36 presets plus a variable control. For external speaker, use wiring shown in ***Fig. 3****. Switch positions: 1—off; 2—presets 1; 3—presets 2; 4—presets 3; 5—variable. Switch shown in position 1.*

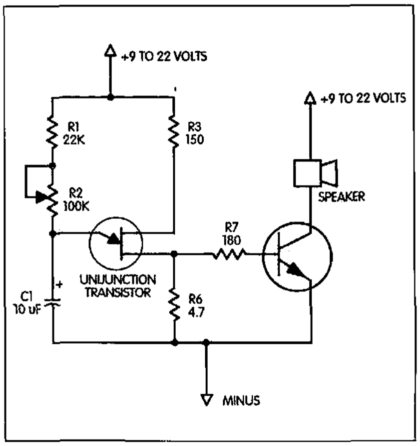


Fig. 4. Basic UJT metronome with booster amplifier gives more volume and will run on lower voltage than the basic circuit by itself. However, it still lacks a good, loud punch, and some of the major manufacturers have made UJTs harder to find by dropping them from their production lines.

Another quick fix

You could put three power diodes, 1N4001s, in series with the output of the 7805, **Fig. 5(b)**. That would give the needed three to four volts. However, I mention it only in passing because I have used 1N400X diodes as temperature sensors and do not recommend them for this application. Certainly, if you can take a slightly less stable instrument, that would work. I do not consider this a precision instrument.

However, tests on the metronomes that I put preset times into repeated their settings within 1%. I try to go for the minimum parts to get the needed repeatability. **Photo B** [*Ed. note:* ***Photos B, C, and D****, and* ***Tables 4*** *and* ***5****, appear in Part 2*] shows a basic, barebones, blue-box metronome with eight preset times and a continuously adjustable range from too slow to too fast.

Photo C shows the final version Joy uses. It has all 34 of the standard tempos, switch-selectable, as well as the variable control. **Table 4** gives the standard beats/minute for metronomes. Since the switches have twelve positions, I added two more tempos to give an even three dozen. **Fig. 3(b)** gives the details if you are that ambitious. Depending upon your needs, you could make a metronome with any number of presets or, as in the case of the basic unit, none. Resetting a control to exactly the same place, in order to get the same tempo, is difficult at best. That is why I made Joy two metronomes with preset tempos. She and her students (now) like being able to get the same tempos each time.

Louder is better

I cannot say why the one circuit malfunctioned. Over the years that I have built this basic circuit, I have seen it hang up once in a while and take out Q2. I do not remember it giving a real problem as long as it had no more than three to four volts on the two transistors, Q1 and Q2, and a collector load no larger than four to five ohms. But staying within those limits did not always give a loud enough sound. That brings us to Q3 and getting rid of the problem of finding a three- to four-ohm speaker.

A substitute gives one way around the problem of finding a small three- to four-ohm speaker. You can find small (but

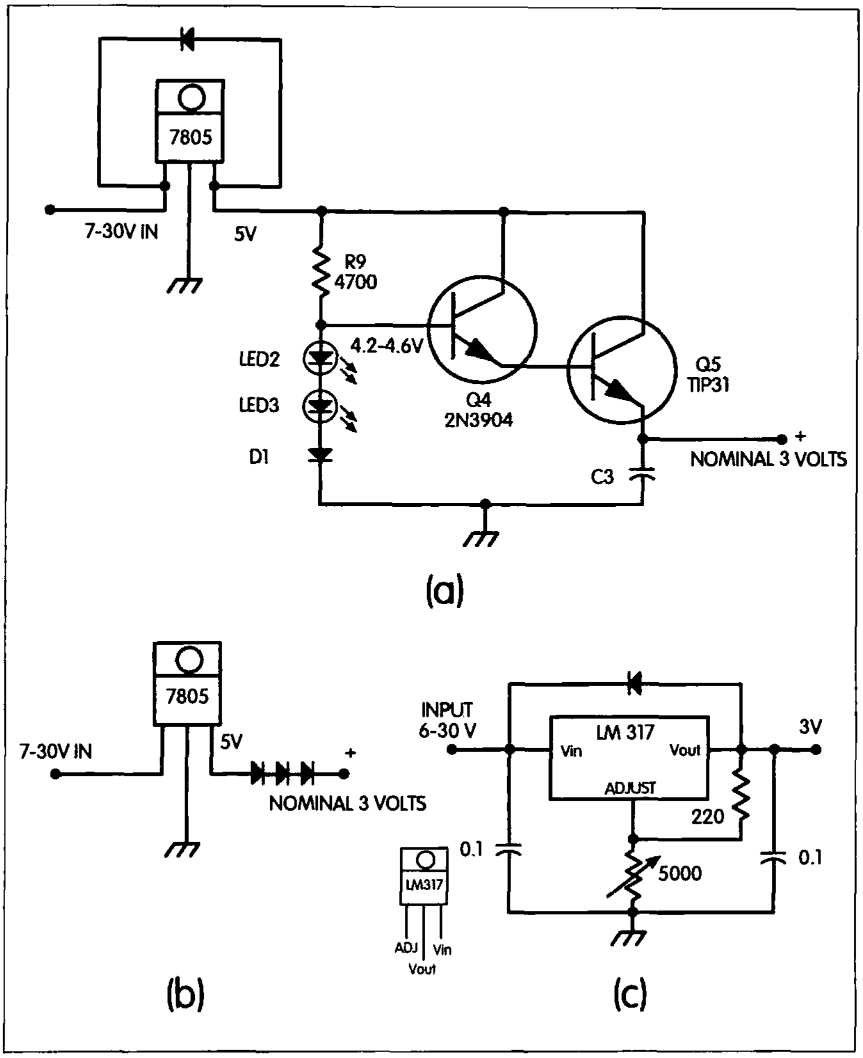


Fig. 5. Regulators, 3 V source. (a) 3 V regulator. Protection diode needed if 5 V is applied directly to complementary pair in ***Fig. 3****. (b) Quick fix 3 V from 5 V regulator (not recommended here). (c) LM317 regulator.*

costly) hi-fi speakers, but you do not want to spend more on the speaker than you do for the rest of the parts. You can make a substitute, though, with one or two 10-ohm resistors in parallel with an eight-ohm speaker.

Loud enough is even better

Connecting the resistors in parallel with an eight-ohm speaker gave 3.3–4.4 ohms where the circuit, **Fig. 2**, needed it. It looked good and played well, but wasted power in the resistors. Also, we wanted it louder—a *lot* louder. So, as **Fig. 3** shows, we made several changes. I substituted two 10-ohm resistors for the speaker. That kept the first two transistors happy most of the time as noted above. A transistor connected across the two resistors could drive any practically-sized available speaker.

An additional battery and the ability to connect a larger external speaker made the system reliable without serious risk of losing the output transistor, and it gave plenty of sound. It allows the use of speakers from four to 32 ohms, and it boosted the sound level enough so that Joy could hear it over the piano, my flute, and her five-year-old. This is several years, and several transistors, after the first request for a metronome. I wonder ...

Never one to leave well enough alone, I had to see how well the modifications would work on the UJT circuit.

Parts List and Presets for Fig. 3(b)								
For the 36 presets plus the variable, add these parts to Fig. 3:								
Part			**Description**			**Notes**		
Switch			2P6T			RS# 275-1386		
Switches (3)			SP12T			RS# 275-1385		
LEDs (4)			Your choice					
Resistors (4)			1/4 W 330 ohms					
Pot			250 k			Circuit Specialists [1-(800)-528-1417] 31VA503		
Trimmers (20)			10 k			32AA401		
Trimmers (16)			50 k			32AA405		
Resistors (36)			Fixed values per presets below					
Presets			**Presets**			**Presets**		
#	**Pot**	**Fixed**	**#**	**Pot**	**Fixed**	**#**	**Pot**	**Fixed**
1	50 k	180 k	13	50 k	68 k	25	10 k	56 k
2	50 k	180 k	14	50 k	68 k	26	10 k	56 k
3	50 k	180 k	15	50 k	68 k	27	10 k	51 k
4	50 k	120 k	16	50 k	68 k	28	10 k	47 k
5	50 k	100 k	17	50 k	68 k	29	10 k	47 k
6	50 k	100 k	18	10 k	68 k	30	10 k	39 k
7	50 k	100 k	19	10 k	68 k	31	10 k	39 k
8	50 k	100 k	20	10 k	68 k	32	10 k	39 k
9	50 k	100 k	21	10 k	68 k	33	10 k	39 k
10	10 k	100 k	22	10 k	68 k	34	10 k	33 k
11	50 k	100 k	23	10 k	56 k	35	10 k	33 k
12	50 k	82 k	24	10 k	56 k	36	10 k	33 k

*Table 3. Parts list and presets for **Fig. 3(b)**. LEDs mount on the front panel next to the preset switch, and next to the variable control. They will give a dim but visible reminder of which control you selected. Fixed resistors varied from 180 k–33 k, depending upon the size of the trimmer and the speed. The slowest speed used 180 k fixed plus 50 k trimmer. The fastest speed used 33 k fixed plus 10 k trimmer. 120 beats/minute used 68 k plus 10 k. To make this economically practical, you will have to get the trimmer pots from someone who sells them for 20–30 cents each. One source is listed. Of course, equivalent parts will work. The use of a frequency counter will greatly expedite setting up the trimmers for this version of the metronome. See **Table 5** (in Part 2). The smaller the trimpot compared with the fixed resistor, the higher the resolution for adjustment. In other words, the smaller pot will make it easier to adjust the preset for the desired setting or beats per minute. In some cases, a 25 k pot would have worked here but was not immediately available.*

Another quick trip to the test bench showed that the "new and improved" (modified) circuit does indeed have more volume than the bare-bones UJT circuit. It may give a loud enough tick for some musicians, and it is a somewhat simpler circuit. UJTs don't cost that much if you have to go to the store anyway. **Fig. 4** gives the circuit for the amplified UJT metronome, one of several options. We will go over some of those options in the construction section, Part 2.

Millen-Dollar Replacement

Here's a clever and cents-ible way to make your own quick disconnect.

Ronald Lumachi W2CQM
73 Bay 26th Street
Brooklyn NY 11214-3905

Linear amplifier builders are finding it increasingly difficult to locate sources even for run-of-the-mill project components. And it's literally impossible to find, at any price, those dead-special items essential to completing that new home-brew amp supply!

For example, try ferreting out a bank of high capacitance/voltage filter caps for the plate voltage supply, a heavy-duty bandswitch, or a rotary inductor that will handle the rigors of full legal power. I can tell you from personal experience that it will take a lot of hamfest legwork to even *begin* to make a dent in your parts list.

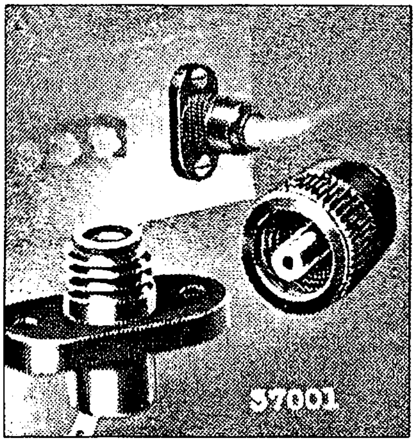


Photo A. *The James Millen #37001 HV terminal/through-bushing has been a handy workhorse for many years.*

High up on this roster of necessaries, and perhaps even more elusive, is the James Millen combination HV terminal/through-bushing #37001 (**Photo A**). That rascal was specifically designed to conveniently disconnect power via a high voltage cable from the remote power supply to the outboard RF deck.

Some builders (including myself) have reluctantly substituted a variety of (expedient) methods to transfer power to the high voltage circuits via a quick disconnect chassis feed-through system. The most common scheme, in the absence of an appropriate component, used an SO-239/PL-259 combination with some essential safety-oriented modifications. Obviously, in this instance, only the center conductor was wired into the circuit. The mods included insulating the SO-239 socket assembly from the chassis ground with a piece of Plexiglas™ and encasing the metal outer covering of the plug with several turns of electrical tape or a length of shrink tubing.

Admittedly this system has many *caveats*, but in the absence of locating a Millen component, the substitute scheme worked reasonably well over the years. However, I readily admit that I was never completely comfortable with this arrangement. The reason became abundantly clear when I inadvertently connected the high-voltage PL-259 to the coax cable input of the linear and fired up the power supply. At that instant I realized it was time for a change!

As a result of that *jolting* experience, a workable solution mystically occurred to me. What I couldn't figure out was why I didn't think of it sooner. In any event, if you had a similar problem, consider the following mini-project. It's an inexpensive, non-bulky, alternate solution to the routing of high voltages around and into the RF deck. It transforms a readily available fuse-holder into a safe and dependable substitute disconnect assembly for addressing the HV uncoupling function.

Finding a Millen substitute wasn't easy!

The least complicated solution to getting high voltage from the remote power supply to the RF deck is simply

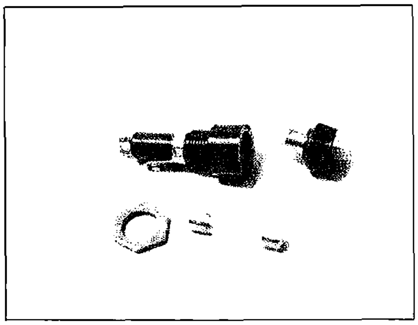


Photo B. The component parts of the standard fuseholder. Make certain that the cap fits the base with a bayonet twist and that the fuse is the correct length and amperage.

to solder the center conductor of an HV cable from the DC output on the supply directly to the base of the HV parasitic choke. Wire in a doorknob bypass to ground at that point, and you're in business.

The case would be closed on this simple problem except that on each occasion involving disconnecting the deck from the supply, the process would involve snipping the lead. When the deck and supply were reconnected after servicing, resoldering would be required. It's a foolproof system, but a tedious chore. It's obvious that the use of a quick disconnect connector would be a welcomed convenience. Cabling up coax, antenna relays, and AGC to the deck routinely employs a variety of connectors, so why not incorporate a similar system for the high voltage hookup as well?

The basic concept underlying this project involves a simple modification to the bayonet-type, molded plastic garden variety fuseholder. These units are available from hamfest vendors, retail suppliers, and a large number of catalog sources for about $0.75–$1.50

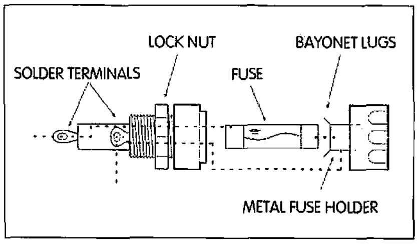


Fig. 1. The unmodified fuse assembly. The electrical path is from lug to lug via the internal fuse (dotted lines).

(**Photo B**). Although it took some time to realize that the standard two-piece fuseholder could be easily and safely adapted to accomplish this task, subsequent experiences with several installations utilizing this device have proven unquestionably that the modified fuseholder serves quite effectively and at a reasonable cost.

Where to begin?

Locate a standard chassis-mount fuseholder in an old piece of gear, your junk box inventory, or at Radio Shack™ (#270-367). Make certain that the removable portion is the type that secures itself to the base with a half (bayonet) twist and that the spring providing tension to the assembly is located in the base rather than in the removable cap. Screw-in types are not feasible, since they tend to twist the HV lead when being installed. Understandably, it's best to get the HV lead securely cabled up with the least amount of manhandling.

At this time, it would be a good idea to purchase a one-amp fast-acting fuse with the correct overall length for the holder. Standard size fuses are approximately one-and-one-quarter inches in length (some are shorter) and are designed specifically for a particular holder. This fuse will be series-installed in the plate HV line later to provide continuity through the holder. In addition, its use provides a measure of protection from parasitic spikes and transients (glitches) that could possibly require tube replacement as a result of an irreparable grid-to-filament short.

To begin, select a drill bit that approximates the diameter of the inner conductor of the HV wire. In the absence of a micrometer, it's perfectly OK to eyeball the size and drill a test hole to ensure that the wire will pass through. You'll find the size to be about one-eighth of an inch in diameter, depending on the gauge of HV wire you're using.

Drill a pilot hole completely through the center of the plastic cap as well as through the metal on the interior of the cap that accepts the conducting end of the fuse. As you're drilling, pay particular attention to the thickness of the

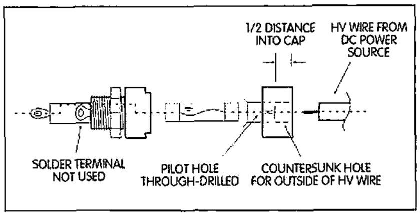


Fig. 2. The modified cap. Note the altered electrical path through the cap (dotted lines). Continuity is achieved through the fuse. Also note the small pilot hole drilled for the HV center conductor and the countersunk hole to accommodate the HV wire. Drill the larger hole to one-half the depth of the cap.

plastic cap. This measurement is important for the next step. In the event you find a small coil spring assembly providing tension within the cap, simply remove it and reposition it in the base of the fuseholder.

For the second drilling step, measure the outside diameter of the HV wire (you'll need a length sufficiently long to reach the DC source) and select a drill bit that approximates that size. A slightly smaller hole is OK. Avoid making the opening overly large, since a snug fit is preferable for a better mechanical bond (discussed later).

Using the smaller hole as the pilot, carefully countersink the second hole approximately half the distance into the plastic cap. You should have a sense of the correct depth of the plastic from the previous step. Remember, you don't have to go too deep, so complete this step with care. Using a sharp knife or razor, remove a sufficient length of outer HV wire protective covering so that the center conductor will reach approximately one-eighth-inch to three-sixteenths-inch beyond the inner cavity of the cap when the outer protective covering rests firmly in the base of the larger countersunk hole. Snip off any excess wire if it extends beyond the length required. Remove some insulation if the inner conductor comes up too short.

At this time, unravel the strands of the twisted center conductor so that the wire is straight along its length. Before moving along to the next step in the process, burnish the metal on the inside/top of the cap to prepare that area for a good solder bond.

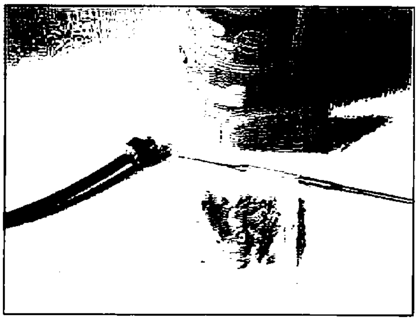


Photo C. After drilling the pilot hole for the center conductor, drill a hole in the cap equal in size to the diameter of the outer core of the HV wire insulator. Solder the center conductor of the HV wire to the interior of the cap, and then apply epoxy to the outer sheathing of the HV wire to ensure a good bond to the cap.

This can be accomplished in several ways. Since the opening is rather small, use a power drill and a drill bit to break the metal glaze. You can also use a small piece of emery cloth. Roll it tightly and work it into the opening. A Dremel™ tool equipped with an emery wheel is a real time-saver if one is handy. Burnish the area thoroughly until you're certain that the solder will adhere solidly. While you're at it, give the top of the plastic cap a quick scuffing with a piece of sandpaper positioned on a flat surface. You'll need a good surface for bonding the wire to the cap with some epoxy used in a later step.

Before proceeding further, make certain that you have a preheated soldering iron with a narrow tip that reaches inside and to the bottom of the cap. Circuit board irons work particularly well here. Flux the inside of the cap as well as the center conductor.

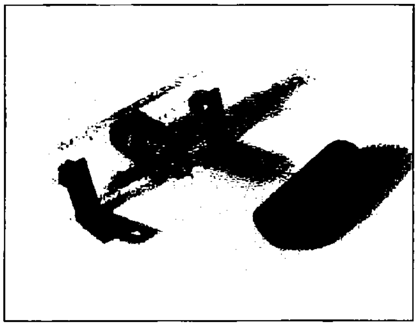


Photo D. A view of the Plexiglas insulator and right angle chassis mounting bracket. The lug visible on the barrel is live but will not be used. Use a length of shrink tubing or several layers of electrical tape over the exposed portion of the barrel lug to protect yourself against shock.

Prepare a small amount of two-part epoxy at this time. Coat the outside of the HV wire (to the extent it will be seated into the drilled opening of the cap) as well as the side walls of the cavity in the cap. Use a toothpick to spread the epoxy evenly (**Photo C**). Make an effort to keep the epoxy bonding material out of the small pilot hole. If any material accidentally gets in there, ream it clean with the unfluted end of the drill bit. Don't tin either the wire or the cap's interior prior to the final step in the installation process. Slip the wire into the pilot hole and push the HV cable firmly down to the base of the countersunk hole.

Check to see that the center conductor extends that short distance into the metal cap. Use a narrow, blunted object to mushroom the short length of wire projecting into the base. The broad end of a good-sized finishing nail or even the pencil-tipped soldering iron works well here. Spread the wire evenly around its center in a sunburst fashion rather than bunching it in one area.

With the cap held vertically (fuse end up), drop a one-quarter-inch length of solder into the base on the fluxed area. Insert the tip of the iron into the cavity of the cap (against the metal and mushroomed wire) and heat sufficiently to allow the solder to flow. Try not to build up too much solder height, because the interior space provided within the holder will be lessened when the fuse is installed. If, after soldering, an attempt fails to get the assembly to lock up in place with the fuse installed, carefully use a one-quarter-inch drill to reduce the height of the solder dome. Make frequent checks until the cap locks together solidly under spring tension.

Use your VOM at this time to check for continuity from the far end of the HV wire (through the fuseholder) to the solder tab at the far end of the fuse. When you get it to fit snugly and the installed one-amp fuse completes the

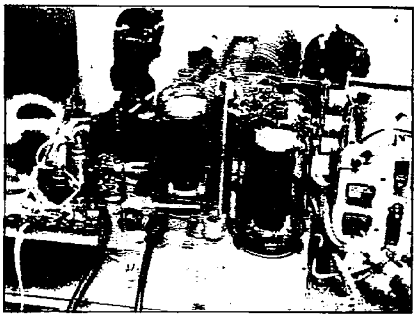


Photo E. The home-brew linear amplifier with the fuse disconnect mounted on the chassis near the HV plate choke. It's a good idea to secure this lead with a plastic-type strain insulator. The small through-chassis hole to the immediate left of the fuse body will be used to bolt a strain relief clamp in place.

series circuit, the mod is just about completed.

Allow the epoxy to set. Wrap the fuse body with several turns of electrical tape since the unused barrel lug connecting point, although still very much in the circuit, will no longer be

Continued on page 80

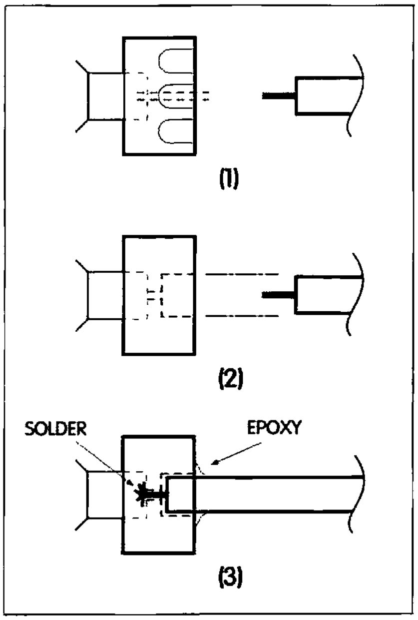


Fig. 3. Cap preparation. Step 1: Drill pilot hole through center of cap and interior fuseholder. Step 2: Countersink the hole (slightly undersized) to accommodate HV wire. Step 3: Scuff top end of fuseholder for better bonding; seat HV wire into base and epoxy; mushroom and solder center HV lead to metal fuse insert.

Number 50 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
E-mail: [clhough@pacbell.net]

Oscillator considerations for 1296 MHz

This month, I want to cover several oscillators that can be used for 1296 MHz. Noting that there are many different systems that can be utilized, each with its own particular attributes and liabilities, I will cover them in a discussion format in order to better inform you on their differences.

What are the different types of oscillators that can be found for use in this endeavor? First is the crystal oscillator/multiplier type. Second, there is the phase-locked "brick" type of local oscillator. Third, there is the synthesizer-controlled local oscillator. I have used each of these at different times and can recommend all three systems for use in construction of a converter as long as you realize their associated quirks.

Let's take them on one at a time. In each description each oscillator will generate 1152 MHz, the frequency required for mixing 1296 MHz down to 144 MHz. The two-meter multimode radio will serve as a base intermediate frequency (IF) for both receive and transmit, with appropriate power reduction circuitry.

The crystal oscillator/multiplier system is easy to construct and available from several kit suppliers. It also can be home-constructed from references in the *ARRL Handbook*. Its primary starting point is a crystal-controlled oscillator normally in the 96 MHz range and associated multipliers to multiply the 96 MHz crystal frequency to the 1152 MHz required for injection to the mixer. (1296 MHz minus 1152 MHz equals 144 MHz for tuning 1296 to 1300 MHz on a two-meter multimode radio.)

Advantages of the crystal oscillator include easy parts gathering and low cost, as all materials can either be put together from a supplier's kit or home-assembled. New cost is in the $50 range. Relatively easy construction, with little test equipment required to assemble. The oscillator produces a very clean output signal, with phase noise down nearly 90 to 100 dB. Liabilities include frequency instability or decreased accuracy in knowing exactly where in frequency you are operating at. Some improvements to this oscillator can be implemented, such as temperature-controlling the 96 MHz crystal. The real problem here is the stability of the local oscillator.

The phase-locked "brick" type of local oscillator is an offshoot of the crystal multiplier system, in that it generates the 1 GHz sum frequency with a high-power oscillator that is under phase-locked control of a similar 96 MHz crystal that is oven-controlled for improved stability. This oscillator depends on the adjustment of the 96 MHz crystal and the matching adjustment of the high-power oscillator to the 12th harmonic of the crystal. When the power oscillator is adjusted very near the 12th harmonic, the sampling circuits produce a phase lock of the high-power oscillator to the controlling crystal.

The sampling circuit receives the 96 MHz crystal and all its harmonics. It also receives a sample of the high-power oscillator. When each is very near frequency, the high-power oscillator is under control of a video op amp that will vary voltage to a varactor in the high-power oscillator compartment which will cause this oscillator to track the 96 MHz crystal and its harmonics. Retained is the very high degree of spectral purity (very clean output) of the basic crystal oscillator. It has many improvements to help stabilize the crystal frequency but still drifts to a smaller degree of less than 1 kHz under best conditions.

Difficulties include the relative expense of crystals ($25). Also, this is a surplus oscillator so other than building a single unit or two, parts might be a problem for a club project. Power requirements can be a problem, as different models require 20 volts normally positive ground although some models are out there which are 20 volts negative ground. If you can find this unit at reasonable cost in surplus use it. It will work quite well for you.

The bricks to obtain are the ones that were used for output frequencies of 5 to 6 GHz. The reason is that the multiplication scheme used was a "times-five." By dividing the output frequency of a 5 to 6 GHz brick by 5, you arrive at the high power output frequency which is in the 1 GHz to 1.3 GHz range. If you divide 5760 MHz by 5 you arrive at 1152 MHz. In the original brick, 5760 could be an obtained frequency but by removing the x5 multiplier and putting a small coax probe in the cavity you now obtain the lower frequency of 1152 MHz. The crystal required is a divide-by-60 or the multiplier (x5) times the harmonic used (12th) or 5 x 12 = 60.

Bricks that were made in the 8 to 12 GHz output range use a quite similar scheme. Different multiplication is involved, which produces a higher local oscillator frequency in the high-power oscillator. These bricks use 1.7 GHz to 2.0 GHz as the high-power oscillator and use the 6th harmonic of the high-power oscillator and the 17th harmonic of the crystal, or 6 times 17 for a total multiplication of 102. There are other possibilities including 6x18 and 6x19 that could phase-lock and produce erroneous frequencies.

I personally have several systems in operation using the brick-type oscillators and they work well. They are somewhat drifty as to frequency. If you want accuracy, you must maintain the oscillator every day to adjust it to proper frequency after a suitable warm-up period. This warm-up time can be several hours before stability is reasonable. Bringing the oscillator into other environments can affect the final frequency and its accuracy. Even with that it still produces a very dependable

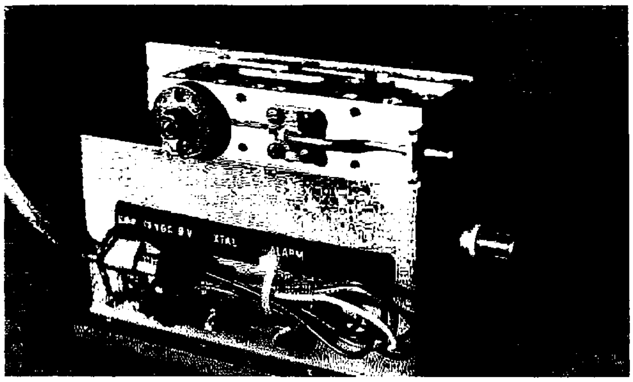


Photo A. Brick-type oscillator from Frequency West. Consists of a 100 MHz (approx.) crystal controlling a high-power oscillator at times 12 to phase-lock the unit. It then multiplies in a varactor to higher microwave frequency. (Multiplier not used when oscillator set up for 1152 MHz and 1296 MHz use.)

oscillator and functions well even with its frequency variance.

The phase-locked synthesizer

The synthesizer type can be costly to reproduce/build and its parts hard to locate. Additionally, if you have to build one it's quite a job, and not a small undertaking. Not wishing to discourage you, I can tell you that the situation is not all that bleak. Our microwave group was able to work out conversions to commercially-built synthesizers that adapted them to amateur configurations. Then the only other problem was to obtain a reasonable quantity of them to allow usage by all those who wanted to give a synthesizer a try. I can't say this enough: The main trick in trying to be helpful is for me not to describe a piece of "unobtainium" or an item not found in quantity. Something must be reproducible or obtainable if it is to be of any use at all to you.

Well, then, what are the benefits of a synthesizer or, more correctly, a surplus commercially-made synthesizer? Like the brick, you start out with a commercially-manufactured piece of equipment that was constructed to very high quality standards. Another—and the main—advantage of the synthesizer is that its frequency output is controlled by a very high accuracy 10 MHz frequency standard. This controls the frequency accuracy of the microwave output to a high degree. A normal accuracy to expect at 1200 MHz is less than 100 hertz. Another benefit is that the synthesizer runs on 12 volts DC and sports onboard voltage regulators. Not a big point, but a plus.

The liabilities of the synthesizer lie in one single point: phase noise. Produced in the synthesizer process, this phase noise is a byproduct that can be minimized but not eliminated. It causes trouble in both receive and transmit by not being a very pure note or frequency source (unlike the products of the crystal oscillator or brick-type methods of local oscillator frequency generation, which are very pure with no extraneous side frequency products produced by the frequency generation process). The synthesizer has extraneous side frequency products due to its method of generation—we call this "phase noise." These byproducts can be suppressed. At present we have been successful in reducing them some 35 dB lower than the main carrier frequency output.

What does this phase noise trouble do to the performance of a converter you might use the synthesizer in? Well, it's like receiving a signal with a receiver with a few "birdies," especially when you get a congested adjacent strong near-frequency signal at the same time you are in communication with someone on a nearby frequency. It doesn't cause any discomfort, but is somewhat distracting and not a pure signal. This effect is not noticeable when there is no other close strong signal present when you are communicating with one station.

One of the greatest benefits that I believe outweighs any possible problem with the phase noise is the frequency synthesizer's frequency accuracy. In many systems these days, the average frequency accuracy is phenomenal. The reason for this is that the synthesizer is controlled by a high-accuracy 10 MHz reference oscillator to which all synthesized frequencies generated are referenced. We have used a 10 MHz reference that is a TCXO (temperature-compensated crystal oscillator) accurate to 1 Hz at 10 MHz to achieve this stability.

Reference this all to 1152 MHz, and the accuracy of the output of the synthesizer is less than 100 Hz error no matter what the turn-on time or the temperature. I am not talking icy to desert-hot, but various changes in ambient temperature will not affect the stability to any great degree. In actual operation, you can consider that from cold start operation at turn-on you can be accurate to a precise frequency and be able to find stations by just a small adjustment of the SSB clarifier RIT control. Most of the time, under various conditions, a receive signal can be produced when both the transmitting and receive station are using similar synthesizers and accurate TCXO oscillators.

In this case, finding a signal without hunting up and down the band is possible. What we

Continued on page 52

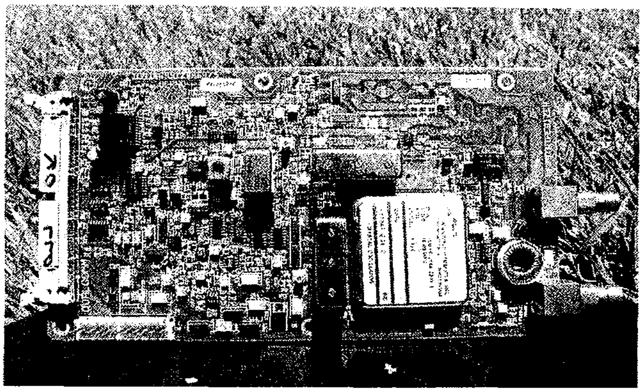


***Photo B.** Qualcomm PC board showing all circuitry on board (much more than required in our conversion). We are using the 3036 synthesizer and its VCO, which runs in the 1000 MHz range.*

Number 52 on your Feedback card

Ask Kaboom

Your Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Trends

Last time, I discussed some ideas for new modes of communication. Given that this is 1998, they centered on digital technology. Like it or not, those darned bits are here to stay! They require new ways of looking at things, but they do have many advantages. Are there disadvantages to digital technology? Yes, there are. The biggest is probably complexity. Although a few chips on a board may not look like much, the action going on in those chips, and the way they work with each other, can be enormously complicated. Why should we care? Well, things we used to take for granted, such as the ability to tweak our gear for some desired performance characteristic, may no longer be possible.

Here's a good example: Back in the 1980s, I got my first 8 mm camcorder. I'd had over-the-shoulder video gear for years, but the small size of the camcorder was a tremendous improvement. The machine made gorgeous pictures, with excellent color. Alas, it didn't perform its edits properly (there were flashes between scenes), so I sent it back for an exchange. The replacement camera edited flawlessly! This one, though, made very greenish color. Sigh. Back it went. The third camera made even worse color. I gave up. Being the inveterate tweaker that I am, though, I couldn't live with that lousy color, especially after having seen from the first unit that nearly perfect color was attainable. Out came the old screwdriver, and I dove in.

In those days, the camera sections of camcorders had anywhere from 10 to 30 adjustments! We take cheap, high-quality color TV cameras for granted now, but there's nothing simple about them. (In fact, the cost of the camera section is what held up the introduction of the camcorder for years, not the tape transport, which is basically a shrunken VCR.) Through some careful measurements and a few "try it and see" tweaks, I was able to deduce which control did what. There were 12 of them, as I recall. It took some time, but I finally diddled that camera into the kind of color rendition it should have had to begin with, and I enjoyed its use for several years, until something smaller and nicer came out, at which time I replaced it.

> **"The board full of mixers, delay lines and other analog processing stuff has been replaced by a couple of tiny chips."**

The new camera made color nearly as good as the old tweaked one had, but not quite. It was certainly good enough, but I just had to see if I could make it ideal. Not this time! There were no color adjustments in that camera at all! Could it really be that manufacturing tolerances had become so precise that a color television camera didn't require any alignment whatsoever? Of course not! So, where the heck were the controls?

The new way

This new camera, which is now about six years old and still going strong, used digital signal processing for the camera section. That means that it took the raw video signal coming from the image sensor, digitized it and then did all the various signal corrections and other processing in the digital domain. The "alignment" consisted of connecting a special programming unit (only available to the manufacturer and some of its factory-authorized service centers) and changing the settings in software in order to obtain the desired performance! Thus, I was completely locked out of making any changes to the camera's behavior. Sure, I could have taken it into a factory-authorized service facility, told them what I wanted, paid lots of money (if they didn't just laugh me out the door) and hoped they got the thing close to what I wanted. I chose instead to just live with it the way it was. Is there an upside to this loss of end-user control? Yes, there is. That camera's adjustments have never drifted one iota, and its performance is exactly the same as it was the day I got it.

Moreover, the performance variation from unit to unit of something built this way is very low; if you like your friend's machine, chances are the one you buy will work pretty much exactly the same. My experience with the three older, analog-based cameras certainly hadn't shown that to be true previously.

This trend toward permanently-adjusted equipment isn't going to go away. Ham gear, too, is going more and more digital, and I expect the pace of that conversion to accelerate dramatically in the next few years as faster and faster DSP (digital signal processing) chips work their way up from the audio chain right to the first mixer of our receivers. Along with the shift to totally digital processing will come the lack of adjustments.

It's happening now. Just a couple of years ago, DSPs were too slow for anything but audio. Then, suddenly, we began seeing IF filtering being done via DSP in HF rigs. The rumors are already floating around that RF-

Continued on page 53

Above & Beyond

continued from page 51

are able to do is announce what frequency we will transmit on and have the receiving station find the received signal with minimal tuning by just adjusting the RIT control. Most signals have been within the audio passband of the mode used, be it SSB (2.1 kHz) or narrowband FM (5 kHz) bandwidth.

You must know by now that I favor the cause of the synthesizer, with all its benefits and liabilities. The main reason is the availability not of a few units but rather of many units, enabling amateurs to more easily acquire a simple, low cost platform on which to construct a transceiver/converter for the higher microwave bands.

If you, on the other hand, can run across other types of oscillators, I do not want to slight them. Use any piece of material you can obtain for a transceiver. This article was written with the goal of giving you information on what the benefits of different types of systems can be and to guide you into making a choice. Hopefully it will let you avoid a piece of equipment that will not function and is priced too dearly.

Next month, I will describe in greater detail the synthesizer we have adapted for use. This synthesizer and its board that we used for the 1296 MHz local oscillator is a different board from the units previously covered for 10 GHz use. While the basic Qualcomm 3036 synthesizer chip is used in both units, the board layout and conversion information are quite different. 73, Chuck.

Number 53 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

Serial modem, soundcard, or plain old TNC?

You, the readers of this column, are very supportive of my endeavors, judging by the mail. You have read of my experiences with packet modems, TNCs, and even SSTV on the soundcard. It is possible to operate packet on any of these devices and it is being done.

To choose one method over another always calls to question the balance between cost and difficulty. This can be hard to grasp until you experiment. From the outside, it always looks as if someone has something working, and that you should be able to duplicate that result. Today, we look at some of the stumbling blocks that test our patience.

Search for components

Sometimes, when you have fought the good fight and come up just outside the winner's circle, you find something that makes the struggle seem worthwhile. Just today, I ran across a packet bulletin from another ham looking for the TCM3105 that is so essential to building a BayCom look-alike. I know the story on them and was glad to offer condolences to someone else who was tilting at windmills.

As the story unfolds, those chips are out of production. I saw some listed for $11 on a Web site. I called the company and could see that I was mystifying them. That was as close as I got. In Europe (where all this 1200b VHF serial modem fun began), they claim another chip, the AM7910 0r AM7911, will interchange, but these chips do not willingly cross the ocean so they are not listed as available here.

Help from abroad

Some of this information was learned by chasing up blind alleys and hearing from a few helpful readers in Europe. Two hams are quite encouraging of our projects. Paulo CT1DTA has successfully implemented a serial modem and the PCFlexnet software, plus he has had the same software up and running with his soundcard. He says his soundcard project runs a little slow, but that with my faster computer, there should be no problem.

Back to the packet modem. One thing at a time. My other cheerleader on that side of the water is George SV2AGW, who writes ham programs and puts them up on his Web site [www.forthnet.gr/sv2agw/]—free for the taking. He was able to find the cross-reference on the modem chip mentioned above.

Another alert reader, Dale (he forgot to include his call, and there are four Dales with the same last name in the QRZ

Ask Kaboom

continued from page 52

speed DSPs are on their way. What does that mean for us?

HF goes modern

Imagine an HF rig the size of a small two-meter mobile. Yes, they already have some pretty small ones, but I'm talking half the current size—or even smaller. This wonder radio will have, at most, a couple of tuned circuits in the front end. It might not even have those! Gone will be the boards full of coils and filters. The incoming signals will be digitized, and virtually everything else, from selectivity to SSB detection and opposite sideband rejection, will be done in the digital domain. Want independent high and low slope tuning? No problem; it's just some numbers fed to a DSP chip! (And the shape factor of the filtering will be phenomenally better than what we now get from any combination of ceramic or crystal filters.) Want multiple tracking notch filters? Again, same thing. How about automatic QRN reduction or a really good noise blanker? A few more lines of code. You get the idea.

The transmitter will be all-digital, too. Actually, some full-sized HF rigs are doing this right now. The incoming audio is digitized, and then it's "mixed" with the bits representing a carrier by doing calculations on the bits. All of the functions of mixers, balanced modulators, speech processors, etc., are done in software. Out the other end of a few chips comes the RF signal, ready for the final amp. And that signal's a darned sight cleaner than what our analog circuits have made all these years.

As hardware gets replaced with firmware (software on a chip), the size, cost, and observable complexity of radio gear will dwindle to the point of absurdity. Chips are small compared to the boards full of coils, caps and amplifier stages they replace. After you make enough of them, they're way cheaper, too. Have you seen how small the new digital camcorders are? Part of the size reduction is due to the new tiny tape and transport, but an equally important part is because the board full of mixers, delay lines and other analog processing stuff has been replaced by a couple of tiny chips. Right now, digital camcorders are very expensive, but, after a few million have been made, they'll wind up cheaper than current analog formats; there's just less in them.

By the way, I say "observable" complexity because the true complexity will be mind-boggling, and far beyond what a hobbyist can explore on his bench with a basic oscilloscope. Essentially, radios will become dedicated computers, just as CD players are now. As with today's PCs, they'll be extremely consistent from board to board, and will be repaired by simply swapping boards when the old one crashes into the old bit bucket. Is this a bad thing?

I don't think so. True, it does kill some of the magic with which we regard our equipment. Then again, let's not forget that "Real radios glow in the dark!" In other words, those accustomed to tube equipment felt exactly the same way when transistors swept the old technology into the dustbin of history. Maybe, one of these days, we'll be saying that "Real radios had parts you could change!" Of course, it'll be a while before the final transmitter stages of HF rigs become monolithic, but it'll probably happen. Heck, it's already happened in VHF and UHF FM gear, hasn't it? When's the last time you saw a two-meter mobile rig with a discrete transistor output stage?

I think it's best to enjoy watching the new ways unfold, without worrying too much about the downsides. OK, we won't be able to tweak our rigs. Then again, we probably won't have to. And just think of the complete HF receiver—with all the hot features and performance you expect from today's desktop behemoths—that you'll be able to wear on your wrist! Don't kid yourself... it's coming.

Until next time, 73 de KB1UM.

database [www.qrz.com]) advised me that SV2AGW was including a soundcard driver with his packet engine program. He thought that would be wonderful if it was as easy to configure as the rest of his programs.

All soundcards are not created equal

This sounded like something to check into, as the PCFlexnet was going to be intimidating to more than just a few of us. Sure enough, there it was, along with a message from Tom Sailer, the one who engineered the soundboard system for the PCFlexnet group.

This deserves a good look, thought this ham (who was becoming more wary by the minute). The driver is specified to work with soundboards using the "PSA chipset," and, wouldn't you know, that doesn't include SoundBlaster™ (which is pretty much standard in the US and is in this computer in front of me).

I spoke to a few knowledgeable computer folk about this and they had no clue what I was talking about. It is a wonderful feeling to know you are on the cutting edge of something like this. The not-so-good feeling is when you realize it is up to *you* to try it and see if it works, because ... that is what is expected.

I loaded George's AGW Packet Engine after downloading the newest free version. I found that the parameters were still there as I had left them from the last use of the old program. After changing to the soundcard parameters, which didn't appear too difficult, the screen message was to reload the program.

The program came up with George's smiling face watching me from the screen, and it churned for a number of seconds. Then there was a crash! It seemed as though I could hear it. Just my imagination, but there were little windows that kept popping up and it didn't look like I would be able to put the program to bed without turning off the power.

It did finally go to sleep, but a reboot of the program caused the same disaster. It just wasn't going to play the game with some foreign (to it) soundcard. The soundcard parameters can't be changed until after the program comes up, and by then, it's dead in the water. Time to delete the program parameter files, try again, reinstall, etc. You get the picture.

He's working on it

I sent George a message about my experiences with the wrong soundcard. "Ah, Jack," he wrote, with his big smile, "I have been meaning to write a driver for that soundcard, but I am having a problem getting all the information." So you see, George must also exercise patience at his end of the spectrum. I feel a little better.

Interestingly, George added the fact that in Greece, most computers are configured as in the US. Of course, he writes programs for those closest to home. George has added help files where he used to claim they were unnecessary. I was experiencing a decisionmaking time and accessed the help file. I don't know what language they are written in, but my US system recognized that they were not in English, so they won't even display.

With a little help, I am beginning to understand there is a definite difference from here to there. It is almost like two clashing technologies. They both work, and will communicate with each other, but many of the pieces do not interchange.

Back to the modem front lines: George did some legwork for me and found a 1200b VHF modem. I had been lamenting how difficult it is to write about these things when there is nothing in hand to experiment with. That should be in the mail in the next few days.

I make some things too complicated

All the while, there was another irksome problem gnawing at me. Since the old faithful IC-260A had died, I had not been successful in replacing it with the IC-2AT. The PK232 just didn't want to converse with it.

To tell the truth, the problem was that I tried something I had not attempted before. I had success for years mating the 2AT to the MFJ-1274 and getting the PTT to work with the capacitive-resistance coupling since there isn't a PTT lug on the 2AT.

This time, just to be neat and tidy, I used the inductive approach. The sad thing was that the received audio, having nothing to do with the installed audio transformer, would not get to the TNC. My conclusion was that I needed a separate audio cable to connect to the jack on the PK232, as was the method with the IC-260A. Not in the books.

I put out a distress call on the CompuServe Hamnet and got several answers, but I didn't explain that I was using the inductive method. Three helpful hams came back: John KA6LWC, Don N2IRZ, and Gary (call?). All mentioned only the capacitive-resistance method—and they had used this combination with no auxiliary cable. This sent a message—it is workable.

The next step was to build another of the not-so-tricky but often ugly interfaces to the 2AT with a resistor and a capacitor. The circuit is simple, but I wanted to avoid the wad-of-tape appearance that so easily accompanies these projects. I have the one made up for the MFJ in a small box. At the time I was experimenting with HF packet and the box included a switch and connectors to two radios.

An idea toward neatness

This time was different, so I found a piece of three-eighths-inch clear plastic tubing. About a two-inch length allowed the AEA-supplied cable to pass through the center, with the capacitor and the resistor on the outside, and a few holes judiciously placed to allow wires to pass through for connection.

It still isn't what I call photogenic—hence, no picture—but it looks like an attempted neatness. For those of you not aware of the problem of interfacing many handhelds to a TNC, the dilemma arises because there is no PTT connector on the radio. Controlling the PTT is a must because there is a lot of automated activity that involves keying the transmitter at just the appropriate time.

Fig. 1 shows the typical wiring necessary to cause the audio input to the radio to energize the PTT circuit. I hear different values being used, but I know these work. One of the contributing hams recommended both sleeves to ground, not just the receive audio shown in the diagram. It seemed redundant but

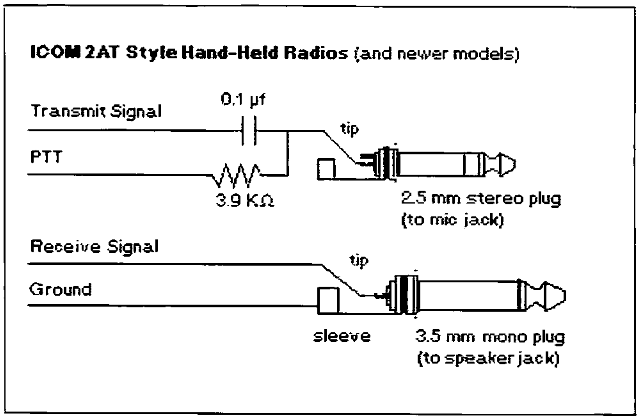


Fig. 1. The diagram can be found at [http://prairie.lakes.com/~medcalf/ztx/wire/i2at.html]. Note—The 2AT uses a mono plug for the mike jack.

Number 55 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Receiving loops & loop preamplifiers: part 1

Small loop antennas are popular for radio direction finding (RDF), foxhunting games, and for improving reception on the lower bands. Surprised? The fact is, even though small loops have less gain than, say, a dipole, the fact that they have deep nulls and are easily rotated make them ideal for reception on very crowded bands. The idea is to improve the apparent signal-to-noise ratio (SNR) by sharply reducing the amplitude of interfering signals. Reception is, after all, a game of SNR with the desired signal competing with QRM and QRN.

Fig. 1 shows the basic form of a square loop antenna. You can build small loops in any shape, but the square is easiest to construct. Other shapes include the circle, the hexagon, the octagon and the equilateral triangle. Before proceeding, let's define small loops vs. large loops.

Small loop antennas defined

Large loop antennas are those with overall wire lengths of 0.5λ to more than 2λ. Small loop antennas, on the other hand, have an overall wire length that is much less than one wavelength (1λ). According to a World War II US Navy training manual, such antennas are those with an overall length of $\leq 0.22\lambda$. Jasik's classic 1961 text on radio antennas uses the figure $\leq 0.17\lambda$, while John Kraus (1950) used the figure $\leq 0.10\lambda$. An amateur radio source, *The ARRL Antenna Book*, recommends $\leq 0.085\lambda$ for small loop antennas. For purposes of this article we will use Kraus' figure of $\leq 0.10\lambda$.

A defining characteristic of small loops versus large loops is seen in the current distribution. In the small loop antenna the current flowing in the loop is uniform in all portions of the loop. In the large loop, however, the current varies along the length of the conductor, i.e., there are current nodes and antinodes.

The small loop antenna also differs from the large loop in the manner of its response to the radio signal. A radio signal is a transverse electromagnetic (TEM) wave, in which magnetic and electrical fields alternate with each other along the direction of travel. The large loop, like most large wire antennas, responds primarily to the electrical *field*

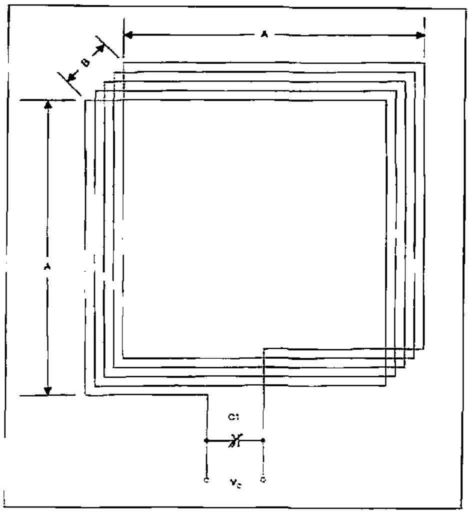


Fig. 1. Structure of the loop antenna.

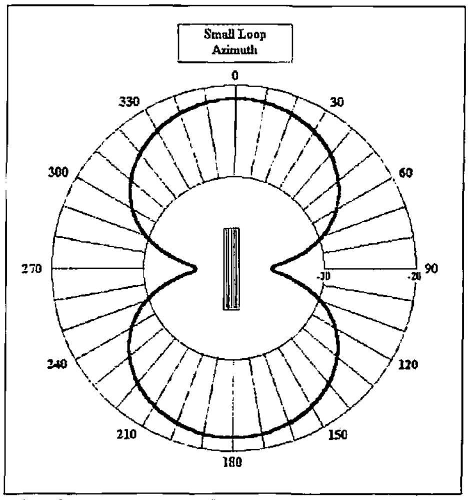


Fig. 2. Directions of maximum and minimum azimuthal response.

I did it, having no shortage of wire.

Some other advice included careful adjustment of the 2AT volume control as well as the threshold control on the 232. Eventually, I plugged it all in. Not watching the activity on the front of the 232, I brought up the XPWare program and, before I had a chance to reach for the knobs, there were a couple of lines of text from the local PBBS displayed.

I was excited! After such a dry period of experiments that didn't pan out, it looked like ... maybe ... by golly ... it'll work. Sure enough, I gave it the command to connect and after some hesitation, the audio signal for "connected to" sounded and everything fell into place.

This has a particular advantage in that I can have both radios, HF and VHF, connected to the same TNC. This eliminates switching cables and life is back to "normal." The only problem? My wife gets a little suspicious when I come out of the shack smiling.

Conclusion

What I alluded to at the beginning of this article is confirmed. Those of us with SoundBlaster cards will not be using them for packet until someone writes a driver for them. When they do, there will be a whole new world open to us. Soon to follow will be all the other digital modes.

The serial modems, which appeared to be toys to many of us a few years back, are well developed. They work well for packet and a new breed even runs 9600b. The HF serial modems are capable of excellent communication—more software is being developed and experimentation continues.

The old-fashioned TNCs like I'm using will be around for a good while. One of these days, though, they will be another item we "look back on." Such is progress—in a form that makes it fun to try to pass along my experiences to you in future columns.

A note: in February's column, the Web address listed for "K7SZL's Unofficial HamComm Home Page" *should* have been [www.accessone.com/~tmayhan].

If you have questions or comments, E-mail me at the address at the head of the column and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @ N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

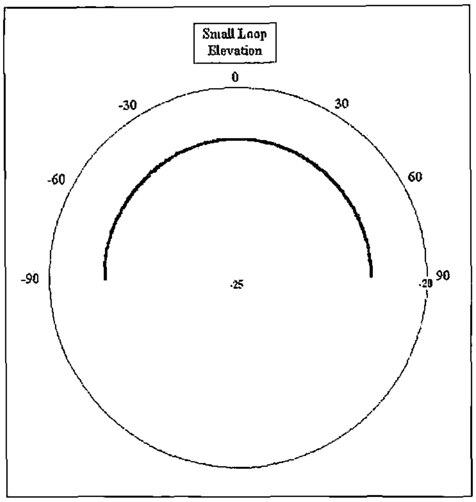


Fig. 3. The elevation aspect of the loop pattern.

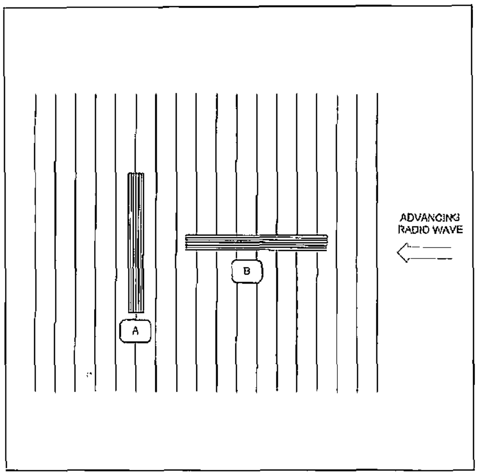


Fig. 4. Why loops produce nulls perpendicular to their plane.

component of the TEM, while small loops respond mostly to the *magnetic field* component. The importance of this fact is that it means the small loop antenna is less sensitive to local electromagnetic interference sources, such as power lines and appliances. Local EMI consists largely of electrical fields, while radio signals have both magnetic and electrical fields. With proper shielding, the electrical response can be reduced even further.

Small loop antenna patterns

Small loop antennas have patterns opposite those of large loops. The minima, or "nulls," are perpendicular to the plane of the loop, while the maxima are off the ends. **Fig. 2** shows the directions of maximum and minimum azimuthal response. The loop antenna is viewed from above. The nulls are orthogonal (at right angles) to the loop axis, while the maxima are along the loop axis.

This is a simulation of a loop pattern, run on the *Nec-WIN Basic* software. The basic model was for a loop that is ≤0.10λ at 1,000 kHz. The azimuthal (horizontal) pattern is shown in Fig. **2**, with a top view of the loop superimposed. Note the pattern "pinches in" along the line perpendicular to the loop axis (90° and 270°), and blooms out (indicating higher gain) along the loop axis (0° and 180°).

The elevation (vertical) aspect of the loop pattern is shown in **Fig. 3**. This is the "side view" of the loop pattern. The plane parallel to the Earth's surface is along the -90° to +90° line, while straight up (perpendicular to the Earth's surface) is the line from horizontal to 0°. This pattern shows equal gain in all elevation angles above horizontal.

The fact that the small loop pattern has nulls perpendicular to the loop axis, i.e., perpendicular to the plane of the loop, is counterintuitive to many people. The situation for two identical loops is shown in **Fig. 4**. The advancing radio wave produces alternating regions of high and low amplitude. The lines in **Fig. 4** are *isopotential* lines, i.e., the signal voltage is the same at all points along the line. A *potential difference* exists between any two lines. The loop antenna marked "A" in **Fig. 4** is aligned such that its axis is parallel to the isopotential lines, while the axis of the antenna marked "B" is perpendicular to the isopotential lines.

Increasing small loop performance

Small loop antennas produce very low output signal levels, especially when untuned. The output voltage can be increased substantially by providing a tuning capacitor (**Fig. 5**). The output voltage increase is proportional to the Q of the tuning capacitor, which can be on the order of 10 to 1,000, with 50–100 being most common.

Two versions of the tuning scheme are shown in **Fig. 5**. The variety in **Fig. 5a** tunes the main loop. A small coupling loop (one to three turns) is provided to actually deliver signal to the receiver. The output of this loop will be approximately 50–100 times higher than the same loop without capacitor C1. The loop inductance can be calculated using equations in The *ARRL Antenna Book*, or by using the *Windows* software on the CD-ROM that comes with my

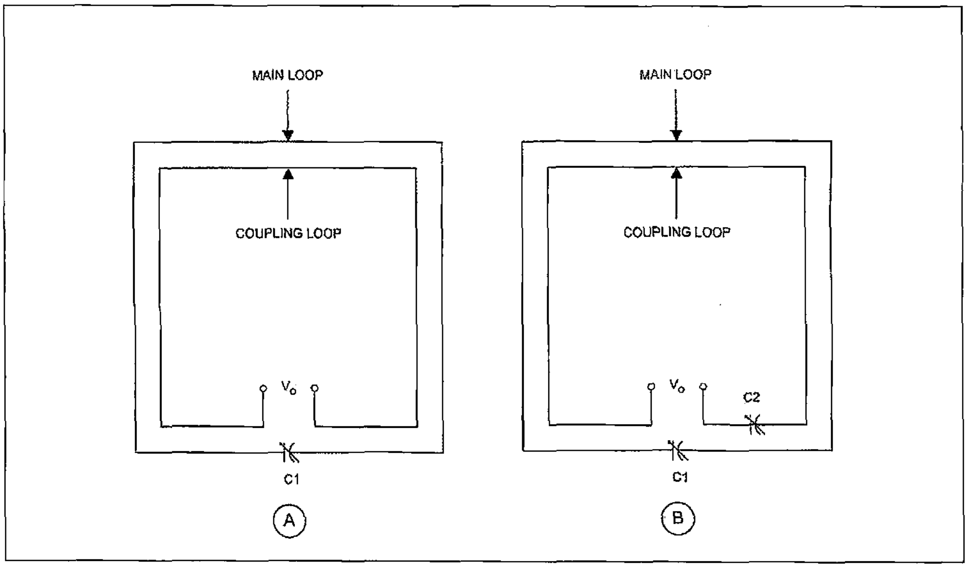


Fig. 5. Tuning loop antennas (see text).

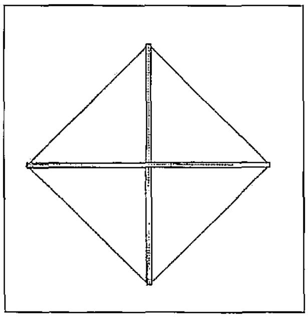


Fig. 6. Basic form for loop construction.

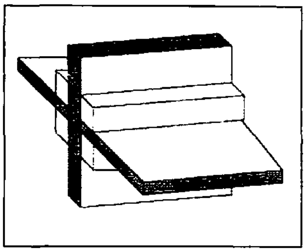


Fig. 7. Center piece detail.

Butterworth-Heinemann book *Antenna Toolkit*. The same software also allows you to calculate the resonating capacitance, and the dimensions of a large number of other antennas. If you are interested in my book, *Antenna Toolkit*, contact B-H [225 Wildwood Avenue, Woburn MA 01801-2041; or call Sales at (781) 904-2603 (voice), (800) 366-2665 (voice), or (781) 933-6333 (FAX)].

The second form of tuning is shown in **Fig. 5b**. In this variation on the theme both the coupling loop and the main loop are tuned. Capacitor C1 tunes the main loop, and C2 tunes the coupling loop. Because the coupling loop has fewer turns than the main loop, it has a smaller inductance. This means that the resonating capacitor for the coupling loop (C2) must be considerably larger than the capacitor for the main loop (C1).

Loop construction

The square loop is, by far, the easiest to construct. You only need to cross a couple pieces of flat wood. **Fig. 6** shows the basic form of this type of construction. The wood pieces are crossed, and the wire stretched across the ends.

The type of wood that is most suitable depends on the size of the loop. For reception in the AM BCB through, say, the 40-meter ham band, you can obtain strips of trim wood from large do-it-yourself hardware and lumber stores. I have seen one-inch-wide by one-quarter-inch- or three-sixteenths-inch-thick wood, and the same thickness in one-and-a-half-inch wide. For LF and VLF frequencies below the AM BCB (e.g., a 60 kHz WWVB receiver), use three-inch-wide by 24-inch-long spruce strips. These are available in hobby stores that sell to model builders. The spruce is (usually) in the same display with the balsa wood, so be careful to get the stronger spruce stock.

Fig. 7 shows how the crosspieces are fitted together. The two strips are cut to equal lengths (e.g., 24 inches). A notch is cut halfway across each strip at the exact center. Smear carpenter's glue or Elmer's® in the notches, and join them together. You will also want to cut some three-eighths-inch- or half-inch-square strips to lengths equal to the width of the main strips. Glue them into the corners of the crossed pieces as shown in **Fig. 7**. It is wise to use small wood screws to keep these pieces of lumber held together. While the glue is still damp clamp the assembly into a position in which the two crosspieces are perpendicular to each other.

The ends of the crosspieces are prepared as shown in **Fig. 8**. Two forms are shown. The left-hand side uses a series of small holes drilled about one-quarter inch from each end. The right-hand side uses slots cut from the edge for about one-quarter inch. The holes can be drilled using the small drill bits used for 0.04-inch printed circuit board holes. Reduced shank drill bits are available that allow them to be used in any drill that accepts one-sixteenth-inch bits. Alternatively, you can get similar bits for a Dremel Moto-Tool™, or equivalent. The slots are cut using a jeweler's saw with a thin blade. The idea in either case is to make an opening that will accept #26 enameled wire without allowing it to slop around. 73

If you are a No-Code Tech, and you're having fun operating, tell us about it! We'll pay you for your articles. Send your stuff to Joyce Sawtelle, *73 Magazine*, 70 Route 202 N, Peterborough, NH 03458.

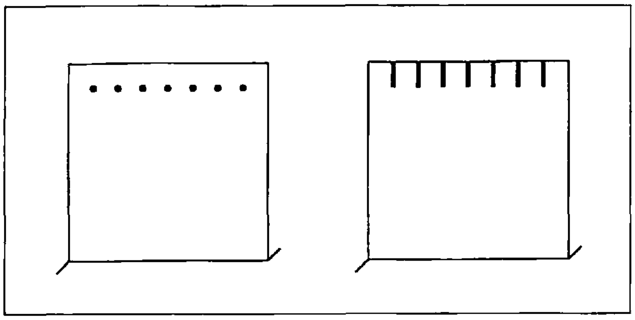


Fig. 8. End details.

Number 58 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[pangen@compuserve.com]

Repeater problems

In most of the amateur radio bands we select an available frequency and communicate with another station. In the most popular UHF and VHF bands we tend to look for a crowded frequency and join in with many other stations. This is not called a pileup—it is called using a repeater. Repeaters allow us to use a frequency which normally would support only short, line-of-sight communications over much longer distances. They also add a whole new aspect to the hobby, since they tend to act as electronic neighborhoods for people with common interests. Some of these interests are practical in nature, such as Amateur Radio Emergency Service (ARES), Radio Amateur Civil Emergency Service (RACES), or SkyWarn for spotting bad weather for the National Weather Service. Others are more hobby- or socially-related.

In a small community, most of the local hams may be limited to a single repeater, but in a large metropolitan area there are a number of repeaters, each of which may be quite different from the others. Perhaps this diversity is because many repeaters are sponsored by clubs, and different clubs tend to have different interests. One repeater may be more oriented toward the hardware and experimental group. Another might be geared toward the public service aficionados or maybe the computer types. Long before the Internet had chat rooms and news groups, the selection of repeaters offered forums for hams with common interests. While a repeater is like a neighborhood, like any other neighborhood it is subject to being invaded by certain unsavory types who do not belong and are unwelcome.

With the growth of our hobby, equipment availability has mushroomed. While this has had many good effects, one of the bad ones is that unlicensed individuals can easily obtain ham radio equipment and some choose to operate it without bothering to get a license. While it may take some effort to construct an antenna and put a station on the air for 75 meters, a two-meter station is easy to operate; requires no external antenna beyond the rubber ducky; and is portable, easy to conceal, and therefore perceived as hard to detect. Certain individuals then take delight in interfering with local repeaters and/or seeing how angry they can make the legitimate amateurs who use that repeater. What are the legitimate amateurs to do in such cases?

"Even though there is the deep-felt desire to punch the offending operator in the nose, this is a questionable approach."

While it is the first reaction of many hams to key the microphone and order the offending party off the air, I don't believe that this has ever been successful. First, the interloper now knows that his transmissions are being heard, and that he's gotten a reaction. Second, it is illegal to communicate with an unlicensed station. FCC Part 97.111 lists those types of transmissions which are specifically authorized. Those not authorized are illegal. Two wrongs don't make a right, but they can make for two citations. As they say, "Never wrestle with a pig—you both get muddy but the pig likes it."

What can be done about such illegal users of the amateur frequencies? The repeater trustees should routinely monitor repeater operations. If unlicensed operators are heard, a number of safeguards can be used to limit the use of a repeater to legitimate users. CTCSS or "PL" systems use subaudible tones which are transmitted simultaneously with the voice message so that the repeater recognizes only those signals which contain the correct tone. Most modern transceivers have this capability built-in, and encoders can be added to most older model rigs. If the intruder is not aware of such practices, this may be sufficient to solve the problem. In some cases, though, it may be necessary for the trustees to take the repeater off the air when the offending party begins to transmit. Locking the door to keep intruders out is not an unreasonable response.

The ARRL has operators in the Amateur Auxiliary designated as Official Observers whose purpose is to assist the FCC by compiling data on violations. The FCC, like many government agencies, has been subject to shrinking budgets in these days of downsizing. The League maintains a database so that the most serious cases can be identified to help the FCC determine where it can most effectively allocate its resources.

A problem which is to be reported to the FCC starts with a written complaint containing as much relevant information as possible. This would include frequencies used, types of operation, hours of operation, etc. If your radio club has a foxhunting group, direction finding information may also be useful. The advantage of using the League's Official Observers is that they are not only more familiar with the FCC's requirements, but they are also willing to help out on the paperwork. Personally, I always prefer it if someone else is willing to do the paperwork.

There are a number of knee-jerk responses that should be avoided. If you get a good triangulation on the offending operator, some think the next step is to confront him. Even though there is the deep-felt desire to punch the offender in the nose (either literally or figuratively), this is a questionable approach. Such actions not only open the individual ham to criticism or possible legal action, but also tend to reflect poorly on the entire hobby.

Amateurs often question why there is no prohibition against non-amateurs owning amateur transmitting equipment. In the olden days transmitters and receivers were discrete devices, whereas today the transceiver is the rule. Some people want to use only the receiving capabilities, especially those who wish to receive while working toward their ticket. I have to admit, when I passed my General Class test and was waiting the interminable six weeks for my license to arrive, I purchased a two-meter HT and intently listened to every local repeater. I had decided which repeaters were my favorites, had programmed them into memory, and was on the air approximately .01 nanosecond after opening the envelope from the

Continued on page 59

Number 59 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

A lesson of *Titanic* proportions

Over the past 18 years of teaching "Introduction to Amateur Radio" to 6th, 7th, and 8th graders at Intermediate School 72 in Staten Island, New York, I've had to change my teaching techniques and motivational lessons dozens of times in order to accommodate the changing times.

The classroom is a microcosm of society, and the advent of personal computers, satellites, cell phones, and the Internet have had a major impact on all our lives, including those of the students I teach. All the oohs! and ahhhs! now have to be elicited through more innovative means. This year I seized upon the Hollywood success with the blockbuster epic *Titanic* to get the children excited at the start of the term.

I've always retold the famous saga of *Titanic* from the perspective of the radio communications. But there has never been a grander way of doing it, thanks to the efforts of director James Cameron.

First, I took advantage of all the behind-the-scenes videos that were being shown on television and brought them into the classroom. The children were mesmerized by the footage of stuntmen, camerawork, flooding re-creations, and modelbuilding that the movie involved. When the bell rang at the end of each class session, nobody moved. They all wanted to stay and watch the end of my tape. Being totally enraptured with the romance and special effects and adventure of the whole story, they were more than primed for me to share the "real" radio story with them.

I chose some excerpts from the Fall 1997 RCA *Proceedings* magazine to read to them. There is a great article by Ray Minichiello in this issue called, "*Titanic* Tragedy Spawns Wireless Advancements." Here are some of the details that kept the kids at the edge of their seats as I dramatically read to them about that most incredible event out at sea.

"The tragedy of the *RMS Titanic*—loss of life numbering 1,500 passengers the night of April 14, 1912—was a great tragedy that seems even greater when one considers that all 2,205 passengers might have been rescued if just a couple of things had happened differently.

"Little has been said (even in the movie) of the circumstances of the *Californian*, a passenger ship that was within sight when the *Titanic* struck the iceberg that caused it to sink. The *Californian* failed to acknowledge the distress flares of the *Titanic* or to turn on its wireless. The passenger ship *Carpathia*, 58 miles southeast of the *Titanic*, responded to the distress call and rescued 705 passengers in lifeboats. The other 1,500 passengers had succumbed to the cold sea.

"The *Titanic*'s sinking generated an opportunity for many to profit on the meager details available. Most details were available through the late David Sarnoff, the Marconi wireless operator, atop the Wannamaker Building in New York City. Sarnoff handled traffic without relief for several days with the *Carpathia* and the shore station at Glace Bay, Nova Scotia.

"Since the disaster that night, stories, books, documentaries and films have emerged with variations of the facts. The fascination about the *Titanic* continues to attract the human soul."

I go on to read them more details about what the wireless room actually looked like. It's also important to understand

Continued on page 60

ON THE GO

continued from page 58

FCC. (Thank goodness for the much faster turnaround we have today!)

Finally, maybe some of the problems we are seeing can be avoided by rolling out the welcome mat. Some of those who listen on scanners to the local repeaters are potential hams, including those who may either become a member of the community or else pose a problem to it. During the local nets make sure there is information about upcoming classes which includes a telephone number for a point of contact. Future hams, Novices, and other amateurs who can monitor two meters but not respond will appreciate this. Don't forget that when the handie-talkie is in the shop, many of us still continue to monitor the nets. By opening the door, you may be able to draw a person into the hobby long before he or she decides to interfere with it.

Identifying a problem is easy. Complaining about it is easier. Finding a solution is harder, but most definitely worth the effort—especially for us.

Number 60 on your Feedback card

Ham to Ham

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Despite the fact that this is the April issue, there's no foolin' in this month's "Ham To Ham" column ... just good practical suggestions! By the way, if you have any that you'd like to see printed in a future issue, all you have to do is jot them down and mail (or E-mail) them to me at either of the addresses shown above. I'm always looking for more practical tips and ideas to grace these pages, so don't be shy. There's a lot to cover this month, so let's get right to it.

First in line, Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the destructive effects of a lightning strike. Part 3 of that series was presented last month; Part 4 now follows.

Lightning protection—what your mother never told you, Part 4

Since the tower is a conductor, and is well grounded, all tower coax lines should be grounded (using approved grounding kits) at the top of the tower, close to the antenna, and at the base of the tower, before they head toward the indoor equipment. During a strike event, the tower and the coax lines will mutually share the strike energy. If the coax lines are not grounded as they leave the tower, or worse, if they are completely isolated from the tower, more energy could traverse the coax cabling toward the equipment than is conducted to the ground system by the tower. This large inductive voltage drop may cause arcing between the coax lines and the tower, which could cause coax deterioration (pinholes in the coax jacket for moisture to enter later) or even complete destruction of the coax lines.

Since all towers have some inductance, leaving the tower at a point above ground will allow some of the strike current to continue on the coax line (both the center conductor and shield), and on toward the indoor equipment. If this current is allowed to reach your ham shack, it will follow the chassis to the electrical safety ground, raising the voltage levels in the cabinets to deadly magnitudes. Remember that inductive drop!

Even though the inductive properties of the coax cable appear to be beneficial, and some

Hams with Class

continued from page 59

the primitive stage of wireless technology of that period.

"The generated signal of the spark transmitter was blunt and broad. Selectivity as a specification for receivers and bandwidth for transmitters was yet to be an established criterion. Hence, during close proximity operation of stations, whoever hit the air first occupied almost the entire spectrum, denying others within close range the ability to communicate unless a tuned circuit was employed to minimize the interfering signal.

"The precise frequency of the *Titanic* and *Californian* transmitters at the time of the incident is not known; nevertheless, whatever the separation, the poor receiver selectivity and the closeness of the two vessels allowed but one transmitter operation. The lack of regulations, as well as the lack of procedures governing wireless operators, resulted in the inevitable blow to the *Titanic*.

"Aboard the *Californian*, the wireless operator, Cyril Evans, turned on his wireless to dispose of his routine traffic. Because of the close proximity of the two ships, however, the *Titanic* operator advised Evans to 'shut up,' as he was interfering with traffic to Cape Race, a shore station. Evans complied. Being the lone operator on the *Californian* and having worked a long day, Evans retired for the night—another unfortunate occurrence for the *Titanic*.

"The *Californian*, just 10 miles from the *Titanic*, had found itself in the same ice field earlier in the evening, at 11 p.m. Wisely, the captain of the *Californian* had ordered his ship to a halt. The *Titanic* struck the iceberg at 11:40 p.m., less than a minute following its sighting by the lookout, but the 'CQ/D' (General Call/Distress) was not initiated until 12:15 a.m., 35 minutes later.

"The *Californian*'s first officer observed white flares shot into the sky from the *Titanic* but assumed them to be shooting stars or part of a celebration on board the 'unsinkable' ship. His uncertainty, nevertheless, prompted him to use the Morse light signal lamp aimed at the *Titanic*, but he received no response.

"The *Californian* did not attempt to send a wireless inquiry to the *Titanic*. Because of this one failure, the fate of the 1,500 lives was doom. Evans, the *Californian*'s wireless operator, had already retired, and no attempt was made to awaken him to assume his post at the key of the wireless station.

"Meanwhile, 58 miles southeast of the *Titanic* was the *Carpathia*. Its wireless operator, Thomas Cottam, was preparing to retire when by chance he initiated contact with the *Titanic* to advise its operator that the Marconi station at Cape Cod was attempting to contact him. The response from the *Titanic* was prompt, with an urgent message naming itself in distress and requesting aid. The *Carpathia* arrived at the scene at 4:15 a.m. On arrival, there was no *Titanic*. Only emptiness, except for the lifeboats containing 705 passengers. By 8:30 a.m., all survivors were picked up.

"The most significant result of the disaster investigations was the call for an International Radio-Telegraph Convention to convene in London on July 5, 1912, for the purpose of establishing regulations and procedures governing wireless services aboard ships and ship-to-shore. Some of the regulations enacted are still in effect today, including 'SOS' as the universal distress call."

Depending on the interest of the class before me, I go on to give more details about follow-ups to the story. The children, like most of us, continue to be fascinated by this provocative incident. There's so much to have discussions about: human behavior in times of emergencies, the arrogance of pride and social standing, regulations governing safety at sea, radio technology and regulations, the many ironies that occurred that evening, etc.

I really love the idea of being able to bring into the classroom a media phenomenon to use as a motivational tool for my radio lessons.

The excerpts from Ray Minichiello's article are used with permission from the Radio Club of America, publisher of *Proceedings*.

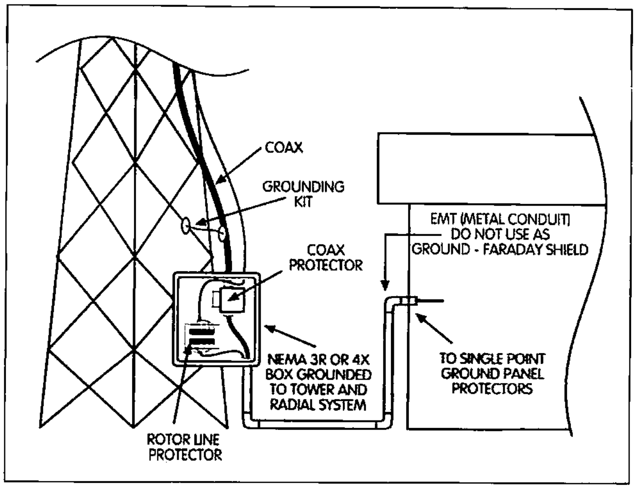


Fig. 1. An additional protection location and shielding plan for cables in a non-basement location.

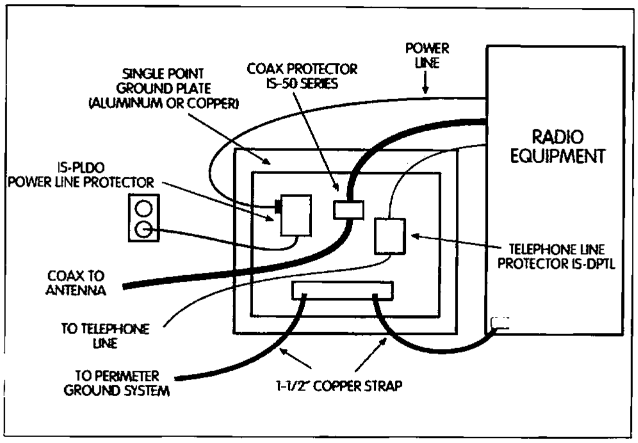


Fig. 2. Typical single point ground installation for rack-mounted equipment.

extra inductance can be created by adding a few turns to the coax cable, it is not normally recommended. The added turns can act like an air-wound transformer, which can actually couple more energy into the line (via radiated pickup). This, obviously, is opposite to the desired effect. Additionally, the coax lines leaving the tower should remain at right angles to the magnetic field surrounding the tower for the least amount of magnetic coupling possible.

Rotor control and coax line protection

Rotor control lines should be protected using a suitable protector at both the top of the tower (where the lines enter the rotor motor), and inside the shack at the single point grounding panel. If it's not practical to protect the lines at the single point grounding panel, protect them at the base of the tower, then run them inside EMT (electrical mechanical tubing or conduit), grounding the conduit only at the tower base. The EMT conduit will act as a Faraday shield from the tower's magnetic fields, minimizing the amount of induced energy. Coaxial RF lines can also be protected from induced energy using EMT conduit, and again, grounded only at the tower base (see **Fig. 1**).

The single point grounding panel

The next step in any good lightning protection scheme is to provide a single point grounding panel, a plate upon which equipment I/O protectors can be located. The panel is best located near the main system ground, again, in order to keep the inductance of the earth ground conductor low. However, if this would require the panel to be too far from the protected equipment (more than 10 feet), and if the magnetic fields of a nearby tower could easily couple into the interconnecting wires and cables (after the single point panel), then the panel should be located closer to the equipment. An alternative (although not as good) to the single point grounding panel might be a dedicated equipment rack panel (if the station equipment is located in a standard equipment rack as is often found in an amateur repeater installation). This is recommended only if all I/O protectors are mounted on the panel and the earth ground connection is directly to the panel and not via any other piece of equipment. Grounding the panel is essential and only copper strap should be considered. Since the strap is flat, its susceptibility to induced magnetic fields is only with respect to its thinner edges. To prevent coupling, the strap should be positioned with the flat side parallel to the tower (the most likely strike point and source of a strong magnetic field). The single point grounding panel should be positioned so that its flat side parallels the tower for the same reason as mentioned for the earth ground strap. Direct grounding (with a heavy conductor) of each individual piece of equipment in a rack is essential if the equipment rack rails are painted (as is usually the case). Painted rack rails afford little in the way of an adequate ground when only part of the screw threads are actually touching ground. **Fig. 2** illustrates one approach to a single point ground when rack-mounted equipment is involved. **Fig. 3** shows how it might be accomplished for a desktop installation. Each installation is different, so you'll have to adapt these examples to your own unique setup. But of greatest importance is understanding the basics, and always keeping those basics in mind when you set about to protect your own ham shack and tower installation.

In the operating or equipment room, each piece of equipment must be bonded to the single point grounding panel with a low-inductance copper strap. This will maintain all chassis potentials at the same level during a strike event, as well as minimize chassis-to-chassis current flow. The power, telephone and coax line protectors on each of the I/Os (equipment input/outputs) must be mounted on the single point panel as well. This will minimize I/O-to-I/O current flow.

Additional protectors should be used to safeguard the feed point or entrance locations for

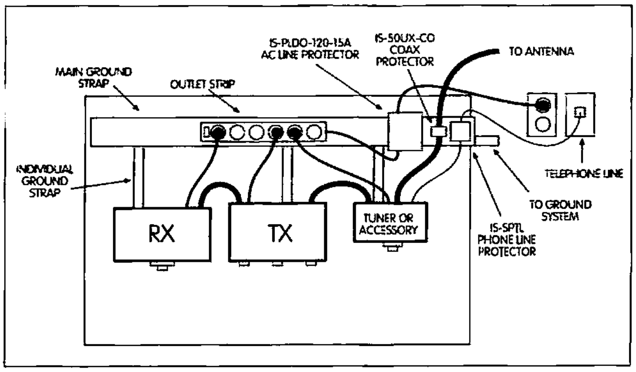


Fig. 3. Typical single point ground installation for tabletop-mounted equipment.

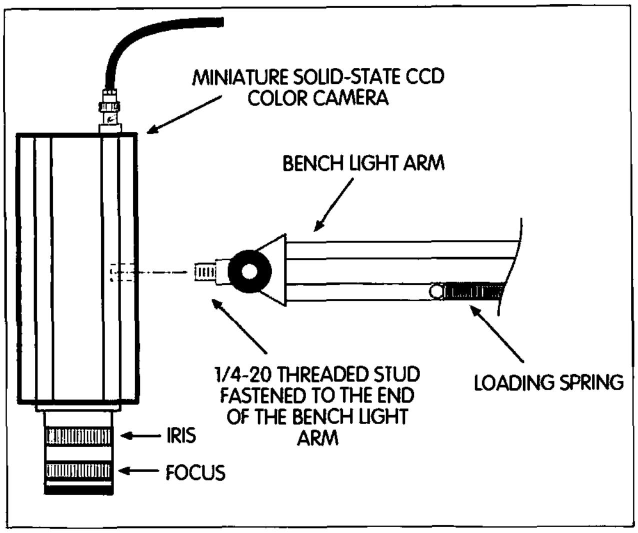


Fig. 4. The modification needed for the clamp-on bench light spring-loaded arm to accommodate the CCD TV camera. The actual details will probably vary from one brand of light arm to another.

the power and telephone lines. These will provide added protection for jointly used equipment such as answering machines, appliances, etc. Ideally, they should also be grounded and connected by a buried bare conductor to the ground system.

Surge energy can enter a shack in two ways: from a strike to the power or telephone lines, or from a strike to the tower. In either case, high-quality protectors will divert the energy into the ground system. Because of varying propagation delays of your ground, if the protectors are electrically separated from each other by a considerable distance, they cannot work in unison to keep the voltage levels between the equipment I/Os within a tolerable range for predictable equipment survival.

Moderator's note: Some of the preceding suggestions may seem like overkill, but please bear in mind that when we speak about lightning, we're talking about an extremely high-voltage, high-current event. Even small resistive or inductive drops can cause huge voltages to be developed ... especially in view of the very low voltages that our modern solid-state equipment is designed to tolerate. But much more important than the equipment to be protected is the life and well-being of the operator ... you! Roger and Ron Block's series will return again next month with more of what mom never told you about lightning and how you can best protect yourself, and your station, from its destructive effects. This ongoing series is "must" reading for everyone who searches the ether in pursuit of that elusive rare one, whether you're a ham, SWL or general electronics enthusiast.

Tape tricks

Here are a couple of uses around the ham shack for plumber's Teflon™ thread-sealing tape that you may not have thought about.

I've found that, at times, plumber's Teflon tape can be used to bail me out when I've accidentally goobered up the threads in a plastic housing, and the screws just turn freely when I try to snug them up. Wrap several layers of Teflon tape around the screw threads and reinsert the screw into the stripped hole. Tighten it down fairly snugly, but not too tight, and the screw may just recover enough "grab" to begin to do its job again.

A wrap or two of Teflon tape around the threads of a PL-259/SO-239 coax connection that's going to be used outside will help to keep moisture from getting into the connection (just as it prevents water from leaking out in its normal use on plumbing pipe threads). In fact, you might want to try wrapping the entire connection with the Teflon tape, then follow up with whatever sealing method you normally use for exterior coax connections (electrical tape, liquid plastic dip, black coax sealing putty, amalgamating tape, etc.). Since the Teflon plumber's tape is very thin and stretchable, it can usually be molded to cover up even irregular forms and shapes that need to be protected from the ravages of the elements.

Teflon tape wrapped around the threads of screws and bolts that are going to be used outdoors will sometimes help in preventing them from oxidizing and corroding in place as much as they otherwise would. If a thin, but reasonably complete, insulating and protective barrier can be established, electrolytic and chemical degradation of ferrous metals used outside can be slowed down (though perhaps not prevented entirely). Even just wrapping the exposed threads of a bolt being used outside will help make that bolt a little easier to remove when the time comes for disassembly—again, enlisting the tape's uncanny ability to conform to irregular shapes that need this outdoor protection.

Bigger is better

From Stan Strasburg W5TPS: "I've been using a special setup to help me to read the smallish print normally used in magazines and on many schematic diagrams, as well as to continue to work on my ham and electronics gear ... a pastime that I love. I have a degenerative eye condition that doesn't permit me to see clearly any longer—particularly small objects in their unmagnified state—but that doesn't have to stop me from enjoying my hobby and its many facets.

"The setup is easy to duplicate using today's electronics ... just use a 23-inch or 25-inch color TV set with a 'Video Input' option (most will have a video input these days), and a lightweight, color, miniature, all solid state (CCD) TV camera. Mount the CCD TV camera on a spring-loaded light arm (the type of arm that's used for most auxiliary clamp-on bench lights), and you're pretty much done! It's usually not too difficult to rig up a 1/4–20 adapter stud arrangement for mounting the lightweight camera to the light arm, but if mechanical work isn't your cup of tea, or you can't see well enough to do it yourself, perhaps a friend who is handy with tools can help. **Fig. 4** shows one such arrangement in a bit more detail, but the actual modification needed will most likely vary somewhat from one brand of bench light arm to another. You may have to be just a bit 'inventive' here.

"The little solid state TV cameras today generally don't require any additional lighting to produce a usable picture on a large-screen monitor, but if necessary, a small high-intensity desk lamp will probably provide enough extra boost in light level. Of course, the end idea is to electronically magnify very small objects (or printing), to a format much more large and bold for those of us with sight deficiencies. The little camera on the adjustable arm is so versatile that almost nothing is 'out of sight' for me anymore!"

Moderator's note: Great suggestion, Stan. This idea can open up a whole new world of enjoyment to those with a visual challenge ... if not yourself, perhaps a friend or neighbor might benefit from Stan's idea. But even if you don't have (or know someone with) small-detail vision problems, the basic idea can be put to work for you when you need to "surgically intervene" on some of today's ultra-miniature circuit boards! Operating room surgeons are using similar techniques to help

them to see what they're working on when delicate surgery is being performed, and we can all duplicate the concept (for a whole lot less money), with just a little time and innovation. If you opt to use one of the very small (and lightweight) CCD 8 mm camcorders on the market today, you can also videotape a complex disassembly procedure, so that putting everything back together again later will be made considerably easier. There's lots of room for individualization here!

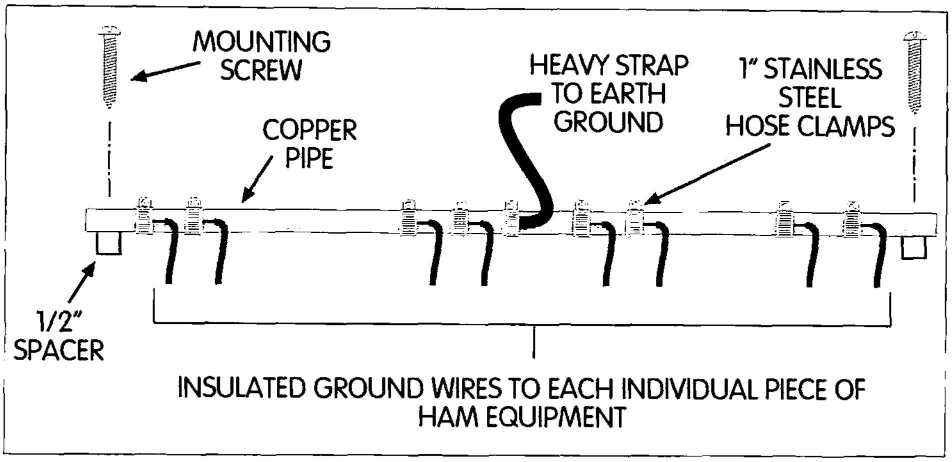


***Fig. 5.** AD4UA's easily-implemented ham operating desk ground bus.*

A well grounded idea!

From Herb Foster AD4UA: "Here's a simple, inexpensive and easy-to-add-to suggestion for how you might be able to implement an effective, single point ground bus on the back of your amateur radio desk ... I've been using this method myself for some time now.

"Simply purchase a length of half-inch copper water pipe, as long as your operating desk is wide. Clean the length of pipe thoroughly, so that it looks nice and shiny. Kitchen cleansers, steel wool and fine sandpaper can all be enlisted to help with this part of the job! Now screw down the shiny pipe, with a husky screw and half-inch spacer, through each end of the pipe, to the back (top) surface of your operating desk. The spacer can be made of any material, even a couple of small chunks of the water pipe itself. The spacer's job is to hold the copper-water-pipe-ground-bus half an inch above the operating desk, so that you can then feed any number of one-inch stainless steel hose clamps around the pipe as the 'tap points' on the bus. All of your equipment ground wires will now go to the hose clamps and be rigidly clamped directly to the copper pipe, but can still be easily removed or relocated should the need arise. Of course a main station ground strap will also go from the copper pipe bus directly to your earth grounding system; **Fig. 5** gives you an approximate idea of what the finished product will look like. You should be able to accommodate dozens of these small clamps on the ground pipe, so that your new operating desk ground bus will never be out of tap-off points."

*Moderator's note: Nicely done, Herb. This is probably one of the easiest-to-accomplish ideas that I've seen for fulfilling the requirement of a solid, separate-wire earth ground for each piece of gear on your desk. Also, take another look at **Fig. 3** as previously recommended by Roger and Ron Block.*

Murphy's Corollary: Any transistor protected by a fast-acting fuse will blow out first, thereby protecting the fuse.

Many thanks as always to the contributors to this month's column, including:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Stan Strasburg W5TPS
1516 W. Magnolia St.
Rogers AR 72758

Herbert L. Foster AD4UA
3020 Pennsylvania St.
Melbourne FL 32904-9063
[ad4ua@juno.com]

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the moderator's address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

Ham Radio Fun

Adventures in Regulation

How to use a fixed voltage regulator in a variable application.

Hugh Wells W6WTU
1411 18th St.
Manhattan Beach CA 90266-4025

Here you are, right in the middle of building a project and—what happened to the variable voltage regulator that was in the junk box? Never fear! Making a variable voltage regulator out of a fixed regulator is very easy, and it will substitute for an LM317 in many applications.

Most any fixed voltage regulator can be made to operate in a variable voltage application, but with some limitations. The limitations involve the voltage range and the method used for voltage control. The voltage range will be from the regulator's output voltage value up to approximately 35 volts. Should a 12 V regulator be used, as an example, the regulated output voltage would be controllable from 12–30 volts. The actual upper value will be limited by the headroom value, typically 5 V, which is the minimum voltage differential between the input and output of the regulator required to keep the regulator active.

If the full variable voltage range is not required in the application, it is best to reduce the input voltage to the regulator or raise the regulator's output voltage in order to reduce the device's heat dissipation. If a 15–20 V regulated output is desired, a 12 V regulator is suggested as a better choice than a 5 V device. A 5 V regulator would be the preferred choice if the output were to be between 5 V and 12 V, but the supply voltage should be kept low, perhaps in the 15–20 V range, to keep down the regulator's heat dissipation. In other words, a 24–37 V source should not be used when only a regulated output below 12 V is needed.

Let's examine a fixed voltage three-lead regulator of the 7805 or LM340-5 type (**Fig. 1**). Having three leads, there is one for the input and one for the output. The third lead is a common reference for both the input and output. The common reference lead is also the tab of a TO-220 device. For the five-volt regulator, the voltage between the output terminal and the reference terminal is maintained at five volts for any load current from zero to 1.5 amps. The same theory is true for devices having a different output voltage.

For regulators to operate properly, their internal amplifier gain must be very high. Although the high gain is desirable, the amplifier gain-bandwidth can cause some serious problems if not kept under control. What this means is that the high gain is desirable at very low frequencies, and undesirable at higher frequencies where the high frequency gain can allow the regulator to oscillate. Bypass capacitors are used across the input and output terminals to reduce the regulator's tendency to oscillate. Although the capacitor values aren't critical, they should be in the range of 0.01-0.1 μF and the lead lengths kept short. Disc ceramic capacitors work well in this application. With the bypass capacitors in place, the gain-bandwidth is reduced sufficiently to stop oscillation. However, the low frequency gain remains high, where it is needed to react against output voltage changes.

Adjustable voltage output

There are occasions when the fixed regulator does not provide the exact or desired voltage for a particular application and it would be nice if the output were adjustable. One of the most common ways of raising the output voltage of a three-lead regulator is to place one or more forward-biased diodes or a zener in series with the common reference lead of the regulator (**Fig. 2**). The

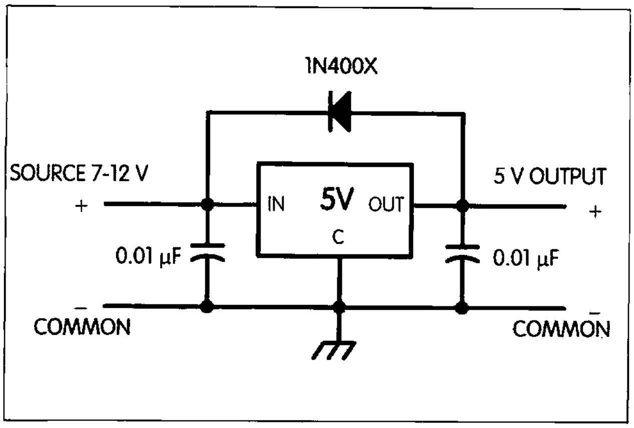


Fig. 1. Fixed voltage regulator using either a 7805 or LM340-5 device.

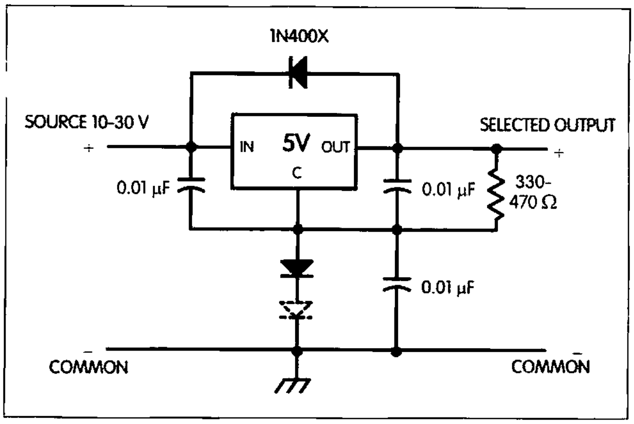


Fig. 2. Fixed voltage regulator with the output voltage selected/adjusted using forward-biased diodes.

output voltage is raised by the value dropped across the diode(s). This technique is suitable for selecting a fixed or stepped voltage value above the regulator's normal output value. The output voltage obtained will be the regulator's output voltage plus approximately 0.7 V for each diode added to the stack. Most any diode will work well in this application, with typical ones being the 1N4148 and the 1N400X (series). The 1N400X series diode is usually the diode of choice because a high forward current tends to stabilize the forward voltage drop across the diode.

To make a variable voltage regulator out of the fixed regulator, it is necessary only to vary the voltage value between the common reference lead and the circuit's common point. The current in the common lead of a typical 7805 regulator is 5.5 mA, and this value tends to remain constant regardless of load current. Placing a low-resistance potentiometer between the common lead and ground will provide a means for varying the output voltage (**Fig. 3**). The output voltage will rise by the amount dropped across the pot, as is the case when a diode is used. To vary the output voltage from 5–30 V, the potentiometer resistance must be varied from zero to about 1 k ohms, with a pull-up resistor of 330–470 ohms to the output as shown.

Although more complex than the circuit shown in **Fig. 3**, an NPN transistor may be used as a variable resistor between the common reference lead and ground (**Fig. 4**). The idea behind using a transistor as a variable resistor is that transistors are more capable of dissipating heat over the entire control range and will provide a smooth control of the output voltage. The voltage drop is quite stable, which makes it the method of choice. Also, the use of the transistor versus the potentiometer method provides some additional loop gain and, if desired, remote sensing for the output voltage at the load which helps regulate the voltage at the load circuit. Several transistor types, such as a 2N2222 and TIP29 with TO-92 and TO-220 case styles respectively, have been used in this application and work well because

Continued on page 84

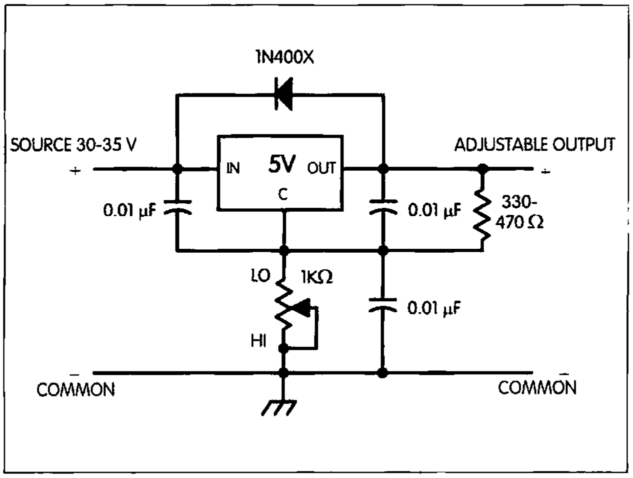


Fig. 3. Variable voltage output using direct potentiometer control. A regulated output from 5 V to approximately 30 V is obtainable.

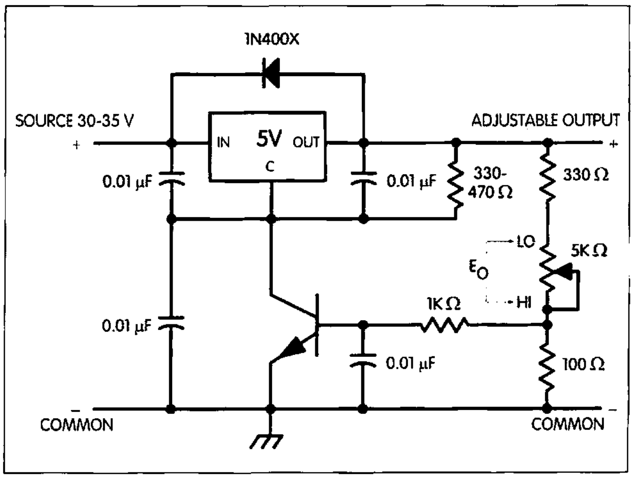


Fig. 4. Variable voltage out control using a transistor. Remote output voltage sensing is available. A regulated output voltage is available from approximately 5–30 V.

How About A Kinky-Interesting-Sexy-Sexy?

A scary trip — one way, thankfully — down phonetics lane.

Dr. Trevor M. Artingstoll GØJOE
1 Whitefriars
High Street
Cambridge CB4 1NN
England, UK

Sitting here in the shack, supping tea, twiddling knobs, listening to the 20-meter contest, one thing is growing abundantly clear: The International Phonetic Alphabet is being misused more often than not. And all nationals are responsible.

Misused? How can extra letters tacked on a letter of the alphabet enabling it to be sounded as a word possibly be misused? A for Ape, A for Algernon—A for Antidisestablishmentarianism. So what? They all begin with A, and that's the one letter we are interested in putting over to the guy on the hot end of the antenna.

Yes, and ... er, no. Many, too many, hams believe that something audible—almost anything coming to mind, in fact, tacked onto a letter of the alphabet can make it a significant sound, a phoneme. Listen on 20 meters any night and you'll get my drift.

Why bother with the dull "Alpha" when "America" does as well? Yodeling, "How about a Kinky-Interesting-Sexy-Sexy?" pries apart the QRM, and surely does a good job of fixing the attention of that YL in Canton, whereas muttering the official "How about a Kilo-India-Sierra-Sierra?" sounds as if the office geek is inviting the Butterfly Princess to afternoon tea and cucumber sandwiches.

This relaxed approach, one so widespread it is planetary, possibly came from a misunderstanding. When many hams think about the matter at all, they believe that the phonetic alphabet, like Topsy, "just growed." It is true that Apples, Butter, and Charley of the 1914–1918 Flanders trenches came from a time in history when Britain was arbitrarily ruling most of the world, so why not boss the frequencies? After all, we invented radio—with an insignificant bit of help from the Eytie chappie, Signor Wotsisname—it'll come to me in a minute ...

You can almost hear the dialogue in that 1915 dugout in Flanders as the phonetic alphabet developed:

"I say, sir, what shall we call the jolly old letter 'A'?"

"Apples, of course, Lieutenant Chuffchuff."

"And 'F', sir?"

"Freddy, Lieutenant Chuffchuff, definitely. After my brother. Rides with the Pytchely, y' know? Damn fine seat."

Since the privately schooled officer-caste of the British forces is more inbred than an Appalachian mountain town, or so I hear, in 1917 the Royal Navy eventually pressed all the service into using its version: Apples, Butter, Charlie, Duff, Edward, Freddy, George, Harry, Ink, Johnnie, King, London, Monkey, Nuts, Orange, Pudding, Queenie, Robert, Sugar, Tommy, Uncle, Vinegar, William, Xerxes, Yellow, Zebra.

"Duff" (think of sourdough with sugar and raisins) and "pudding" got there undoubtedly because sex was kicked out of them with rugby and cold showers, so comforting eating was in. At Rugby, "Edward" was the aide of the commissioning officer—they were very, very close; Edward would do anything for a dare. "Monkey" wittily followed by "Nuts" laid them flat in the wardrooms and officers' messes of His Majesty's military. "Xerxes" showed they had studied the classics even if they hadn't understood them. "Ink" was sheer nostalgia for the times they flicked blobs of it at one another during prep.

The immortal F.J. Camm, editor of *Practical Wireless* and whose books

are now collectors' items, tried in 1946 to internationalize what seemed a set of class attitudes. Perhaps military service abroad had made him realize that the occasional Italian and Spanish operators were out there, too.

In *Newnes Short-wave Manual*, he came up with: Amsterdam, Baltimore, Casablanca, Denmark, Edison, Florida, Gallipoli, Havana, Jerusalem, Liverpool, Madagascar, New York (Oh, can't you just imagine the chaos after "New what?"), Oslo, Paris, Quebec, Roma, Santiago, Tripoli, Uppsala (There's no such place, surely?), Valencia ("'*B*' for *Balenthia, señor?* We pronounce 'V' as 'B' in Spain!"), Washington, Xanthippe ("No, I do not mean 'boz,' muttonhead—'Zanteepee' is how you say it, but it looks 'X'—'box' damn it, b-o-x, I spell Baltimore—Aw, what the hell!"), Yokohama, Zurich.

Camm may have been the first to make many peacetime English aware that the jungle doesn't begin just past the low-water mark. Begins at Calais ...

About this same time, the Royal Navy began getting its act a little more together, feeling its way toward a scientific system of phonetics. Eventually it came up with: Able, Baker, Charlie, Dog, Easy, Fox, George, How, Item, Jig, King, Love, Mike, Nan, Oboe, Peter, Queen, Roger, Sugar, Tare, Uncle, Victor, William, X-ray, Yoke, Zebra.

Things took a backward step in 1963—well, in ham radio they did, and only for a time. Fancy phonetics not being the preserve of the Brits alone, in *Understanding Amateur Radio* (1963) George Grammar, Technical Director of the ARRL, weighed in with West Point severity: "Most of the time, amateur operators use some sort of phonetics—some of these are 'cute,' some have no business being used on the air, and some serve the purpose of aiding in the identification of your call letters (when) interference may be heavy.

The ARRL has adopted such a phonetic alphabet, as follows." And he went on to list: Adam, Baker, Charlie, David, Edward, Frank, George, Henry, Ida, John, King, Mary, Lewis, Nancy, Otto, Peter, Queen, Robert, Susan, Thomas, Union, Victor, William, X-ray, Young, Zebra.

Yessir! Will history ever tell us who the ARRL Mr. Quiverful was with such a big family? And why was poor little "Union" sacked from his very first job in Little Rock? But "Xanthippe" is no more, did I hear? You really think so? Please read on.

George Grammar, in the turmoil of the time, had taken his backward step through not having come across a book written a decade earlier. With the uncanny prescience certain writers can show, Robert Hertzberg K4JBI had published *So You Want To Be a Ham?* in 1955. In it, he remarked that the FCC had not prescribed an official phonetic alphabet, "which amateur radio sorely needs." He went on to say that the most generally used form was one growing out of a United States-British military agreement. This turns out to be the Royal Navy alphabet above: Able, Baker, etc.

"More recently," he goes on, "a new international alphabet was adopted by the military services and commercial airlines." Hertzberg notes that this new form has multi-syllabic words with the stress coming naturally on the first. The words of the older form are practically unstressable, he notes further. Remember plucky little "X-ray" hanging in there?

The British used "R" for All Received Correctly in CW, but the Americans wanted to use "OK." They abandoned this, Hertzberg claims, as part of the same military agreement. Phone was being used more often than CW and it seems the Brits regarded "OK" as far too flippant to be used in our tightly disciplined armies.

So "Roger" was born, and quite rightly, too. Even so much as thinking "OK" in the presence of five feet of red-tabbed-uniformed aristocratic mediaeval over-privileged gives me the cold shudders.

But from Hertzberg's book it is clear that science had entered the world of the international phonetic alphabet. Multi-syllabic words with stresses naturally on the first is a quantum leap from "Ink." Science was coming to the rescue.

Was a rescue needed? If'n it ain't broke, why fix it? To answer this important question, I must move away from the topic a little. Toward the end of the twentieth century, as we all know, some cowboy contractor from Sirius 5 began remodeling Earth into the Global Village. Now, nation really does speak unto nation; nightly, Inuit operators fade into the QRM, being replaced by Sioux whizkids working Madagascar five and nine with Fiji on the side—come in, Arran! We are becoming villagers, all living on one whirling space-born hamlet, Planet Earth.

This internationalizing (and democratizing) of the ionosphere matters zilch to the average WASP ham, of course. Fondly imagining English is the master language of amateur radio, we tune up nightly, happy inside our cultural bubble with its drawn curtains. Few of us realize that English is often being politely spoken for our benefit by polyglots aching to chew the rag maybe in Basque or Farsi as soon as we go QRT.

Zilch to us, but the need for effective communication is wider than mere hobbies or even national frontiers. International industries such as airlines can literally live or die by effective phonetics.

Imagine, for example, this scene from my latest interminable catastrophe film, Airfield Destiny, *starring Slagbag O'Hara:*

It is night. Thick fog, an Army smoke screen laid by accident across the airfield, and a power blackout are making conditions rather difficult.

"You're landing too far down the runway. Brake, for God's sake, Flight 1003!"

"Er, what-a you say, control tower? No 'ear you too good."

"Brake, Flight 1003! Please, for Pete's sake! You're coming right at us. Baltimore - Rome -"

"No want-a Baltimore - Rome, why you say Rome - ees Roma - no want-a Rome - want-a Boston. This-a Boston, capice?"

There is the sound of something splatting. Yet another control tower bites the dust. OK, OK, so the director drank.

They called it pilot error, when in fact it was phonetic error. It's such a

PHONETIC RADIO LANGUAGE

	ENGLISH	GERMAN	FRENCH	ITALIAN	SPANISH	PORTUGUESE
A	Alpha	Anton	Alfa	Alfa	Alfa	Antena
B	Bravo	Berta	Bravo	Bravo	Brasil	Bateria
C	Charlie	Casar	Charlie	Canada	Canada	Condensador
D	Delta	Dora	Delta	Delta	Delta	Detector
E	Echo	Emil	Echo	Europa	Espana	Estatico
F	Foxtrot	Friedrich	Foxtrot	Firenze	Francia	Filamento
G	Golf	Gustav	Golf	Guatemala	Guatemala	Grade
H	Hotel	Heinrich	Hotel	Hotel	Hotel	Hotel
I	India	Ida	India	Italia	Italia	Intensidade
J	Juliet	Julius	Juliett	Juventus	Japon	Juliete
K	Kilo	Konrad	Kilo	Kilometro	Kilo	Kilo
L	Lima	Ludwig	Lima	Lima	Lima	Lampada
M	Mike	Martha	Mike	Messico	Mejico	Manipulador
N	November	Nordpol	November	Novembre	Noviembre	Negativo
O	Oscar	Otto	Oscar	Otranto	Oscar	Onda
P	Papa	Paula	Papa	Palermo	Papa	Placa
Q	Quebec	Quelle	Quebec	Quebec	Quito	Quadro
R	Romeo	Richard	Romeo	Romeo	Radio	Radio
S	Sierra	Siegfried	Sierra	Santiago	Santiago	Sintonia
T	Tango	Theodor	Tango	Tango	Tango	Terra
U	Uniform	Ulrich	Uniform	Universita	Universidad	Unidade
V	Victor	Viktor	Victor	Venezia	Victor	Valvula
W	Whisky	Wilhelm	Whiskey	Whisky	Whisky	Watt
X	X-ray	Xanthippe	X-ray	Xilofono	Xilofono	Xilofono
Y	Yankee	Ypsilon	Yankee	Yokohama	Yucatan	Yucatan
Z	Zulu	Zeppelin	Zulu	Zelanda	Zulu	Zulu

***Table 1.** List of international phonetics.*

dated mistake. I recall a schoolboy joke of the maid on the telephone spelling London "L for Lulu," and a voice at the other end asking, "L for what?" The pilot similarly was caught up in analyzing the meaning of the phonetic words when what they meant was irrelevant to the initial letter each was carrying.

"Sierra" can do that to me still. I took a camping trip in the Spanish Sierras years ago with this very active girl ... very. "Sorry. Please repeat all after 'Sierra'. OM."

The saga has a happy outcome. By 1975, the planet was on track with our tried and true buddies, Alpha, Bravo, and the rest of the gang. (See **Table 1**.) And this gang almost satisfies the four requirements whose absence the airfield scenario is intended to illustrate.

The first requirement is to make the alphabet politically correct. The various radio organizations of the world are refusing just any old bundle of phonemes these days. If Lebanon has been invaded by Marines again do not expect a happy reaction when using "America" to spell out your callsign for a patriotic ham in Beirut. Sending "Afghanistan" up 30,000 feet to an Ilyushin airliner during a tense moment over Washington could cause grief, too. "Waterloo" is never acceptable to French ops. Give you one guess!

Doubtless readers can think up their own lists of unacceptable phonemes. They called me "Four-eyes" at school. Just try me with "F for 'Four-eyes'" and see what happens to our QSO!

The second requirement is that the words must be international, or as international as possible, Old Norse, Sinhala, and Erse being what they are. Hams all over the planet must be given a chance of recognizing at least some of the words immediately as being from their own languages, making the alphabet easier to learn and more acceptable.

The existing alphabet goes a long way to doing this. Alpha and Delta are Greek; Sierra is Spanish; Yankee (Yanqui) is Red Indian.

Words not native to a language still have a good chance of being recognized, remembered, because they have international currency: Foxtrot, Hotel, Golf, India, Zulu.

Poor Topsy doesn't get a look in nowadays—internationally used phonemes are too important just to be allowed to grow.

Which brings me to the third, very important, requirement: aural standardization. Phwah! I can't believe I said that, but nothing else will do. It was hearing this standard breached so often which got me researching this article.

When communicationally challenged members of the human race take to the airwaves and the QRM is thick enough to stand on, Pablo, QTH Madrid, and Stanislav, QTH Minsk, can both write down "S" when each hears only "Eeerra" or even "Erra" instead of the full "Sierra". If, however, aural standardization is disregarded and Stanislav launches "Stalin" at Pablo and "In-" alone gets through the electric soup, where does it leave the poor onion-eater? No informed guessing is possible. And if "Lin" is something unmentionable in Spanish, it could cause an incident, or even an Incident! Spaniards are a proud people!

The fourth requirement is satisfied if we follow the stipulation of the

prescient Hertzberg that phonemes should be multi-syllabic with the stress on the first syllable.

Imagine loose-mouthed GØJOE trying to insult someone over the air, call him an idiot, say. The other guy is hitching through Rwanda which in itself is a good reason to call him an idiot, but he simply can't be insulted because of wall-to-wall QRM.

"Did y'all say 'hot', GØJOE? Sure as hell is."

He has only received the last syllable of "idiot." So off I start with a pre-1917 monosyllabic phoneme, "Ink."

"Y'all got some hassle with your mike theah, GØJOE? C'n hear a squeakin' like one o' them pesky field mice back home in Tinnasee."

Stupid old me; stupid old idiot, come to think of it. If the three-syllable word "idiot" has not got through, maybe allowing *him* to hang onto one of the syllables and try guessing the other two, what chance does a single syllable have?

Thus, not only must a phonetic word be internationally acceptable, familiar to all users, and aurally standardized, it must have more than one syllable—preferably no more than three.

Now enter the modern International Phonetic Alphabet! The words of this little darling have not just growed, they have been hand-picked!

Table 1 shows that the English and the Americans are using it. Even the French. The Germans? I don't believe it! "Xanthippe" is taking longer to die than Olivier in *Brideshead Revisited!*

Italy and Spain have a long, long way to go. "It's in the box, *signor*. Box! I spell 'Brazil - Oscar -X' — now what in tarnation are they using for 'X'? 'Eksilofono'—what the hell sort of a word is that? 'Zilofono', did you say, precious heart? No, that will be for 'Z'."

But "our" Franco-WASP phonetic alphabet obeys the four requirements listed above:

1. It comprises only politically correct words—excuse?

"Waal, son, down heah in Alabama that there 'Y' fer 'Yankee' ain't the best-sounding word we ever knowed."

2. Each word should appear in as many languages as possible.

3. We must use these words and no others.

4. Each word must be of more than one syllable. "Mike"? "Golf"?

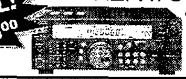
One thing seems clear. If this burgeoning problem is not snuffed out quickly and firmly, I foresee growing anarchy, with personalized phonetic suffixes taking off until the entire phonetic alphabet becomes split between individuals as it is now to a certain extent between nations (see **Table 1**).

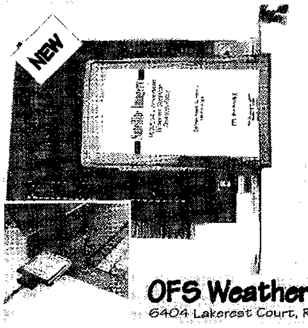
To put this vitally important alphabet back on single frequency perhaps *73 Amateur Radio Today* might consider organizing an International Phonetic Alphabet Day? Twenty-four hours could be set aside each year, during which every sexy misuse on SSB, two meters, and 70 cm can be politely, gently identified, and the correct, lusterless, boring usage given in place of it. Lives could be saved.

Politely, I stress. Ideally, QSOs beginning, "Listen, cow brain!" should rarely, if ever, take place. And be gentle! Kickings must be kept to an absolute minimum. We do not want torrid incidents of Radio Rage fenestrating eardrums, filling the hospitals ....

Maybe on Signor ... er ... Wotsisname's birthday? The Eytie chappie? It'll come to me in a moment, Lieutenant Chuffchuff. Bear with me ....

My thanks to the Radio Society of Great Britain for giving me the use of its legendary library in Lambda House, and special appreciation to librarian John Crabbe G3WFN. His graciously proffered cups of coffee, as well as yarns and indications of likely books to advance my research, made my visit pleasantly memorable. 73





The Kelowna Kactus Home-Brew Antenna

And we mean home-brew!

Ron Brillinger VE7RFB
358 - 550 Yates Rd.
Kelowna BC V1V 1Z4
Canada

Here is the description of a two-meter antenna you won't find in *The ARRL Antenna Handbook*. I needed a high efficiency antenna for my attic, since the subdivision into which we had just moved had legislated complete prohibition of antennas.

This would be a vertically polarized antenna, exhibiting low-angle radiation and fitting into the 10-foot height of my attic. I would use copper pipe to fabricate the antenna and its phasing sections, because I wanted to keep I^2R losses very minimal.

Figuring that I could accommodate two half-wave sections, one above the other, in the space available, some kind of vertical collinear design seemed in order. I wanted to feed the antenna with coaxial cable at the bottom.

The arrangement for my Kelowna Kactus I finally decided upon was a sort of double extended dipole with a J-section feed. Dimensions are shown in **Fig. 1**. As I said, I wanted to keep losses to a minimum, so I silver-soldered the pieces of copper pipe together and used plastic end caps to keep out moisture. After assembly, I mounted the antenna in the attic and fed the coax down to my radio.

Improvements (?)

The antenna seemed to work well enough, but I got to thinking that it might have a lower angle of radiation and work better if I could equalize the antenna current in both of the half-wave sections above the J-section. *The ARRL Antenna Manual* suggests that bending a portion of a matching section in the direction of the radiator closest to the feedpoint could help to equalize currents in the antenna sections, so I "re-engineered" the phasing section in the middle of the antenna to give it a slight droop, about seven degrees downward at the outer end.

Being a little concerned about condensation in this downward sloping section, I drilled a 3/16-inch hole at the bottom for drainage.

Further testing showed that the angle of radiation from this omnidirectional antenna was in fact very low. My two-meter signal was getting out!

Things heat up

It was during one of my many trips to the attic to prune the antenna for best SWR at 146.940 MHz that I noticed that the bottom 18 inches or so of the J-section (down where the coax input cable was connected) was getting really warm. You might even say *hot!*

I found a small oven thermometer and taped it to the copper pipe near the bottom of the J to see just how hot it was getting. The temperature was reaching upward of 172 degrees Fahrenheit after each short transmission!

Heat equates to losses, so clearly something had to be done to lower the temperature in the copper pipe. I decided to fill the pipe with a cooling liquid.

My first thought was to use distilled water to fill the lower section of the copper pipe, but I was concerned that the attic might get cold enough in our Canadian winter to freeze the water, causing expansion that would crack the pipe.

I thought of dissolving salt with the water to lower its freezing tempera-

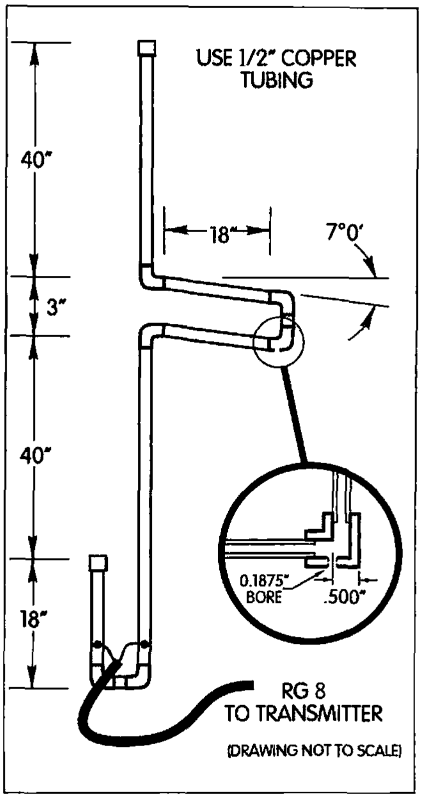


Fig. 1. The Kelowna Kactus two-meter antenna.

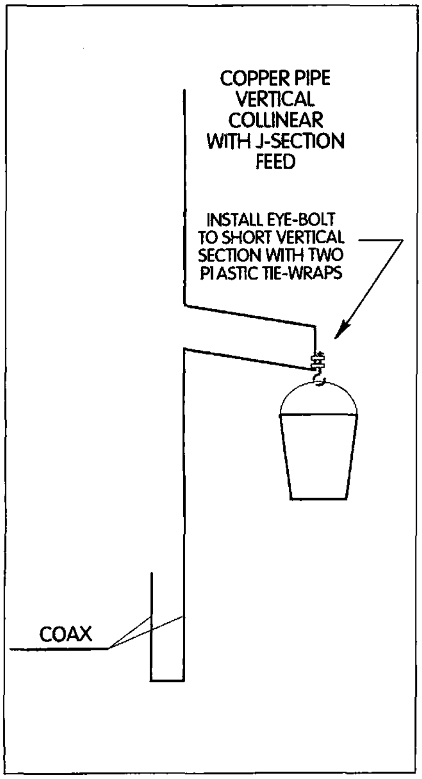


Fig. 2. Installation of the plastic bucket. A small eye-bolt is attached to facilitate bucket removal.

ture, but the idea of salt coming in contact with the copper and causing corrosion made me discount that idea.

Sweet solution

My wife Margaret was in the kitchen making bread when I took leave from testing for lunch, and I happened to observe that she was mixing flour, yeast, and sugar. Yes, sugar!

This gave me the inspiration to liberate some from the kitchen counter and add it to the cooling water in my antenna. I mixed up enough of this anti-freeze solution to fill up the J-section at the bottom of my copper-pipe antenna.

I then reinstalled the plastic caps on each end of the pipe to prevent evaporation.

Further testing of the antenna over the next few weeks showed that it was performing, but the lower J-section continued to get quite hot during each transmission. Hot enough, in fact, that steam could now be seen pouring out of the 3/16-inch hole drilled at the bottom of the matching section.

And furthermore ... the steam had a peculiar odor! A drop of funny-smelling liquid gradually collected on the end of the matching section. I touched my finger to it and cautiously tasted. Hmmm ... *Could* it be? It sure *tastes* like ...

So I suspended a small bucket below the drip hole as shown in **Fig. 2**, to collect more of this nectar ... and after an hour or so of calling CQ, I had collected about two ounces of ... *tequila!*

Does my Kelowna Kactus antenna work as well as expected? Well, no—it doesn't—but who cares? I've no problem with the necessary continual operation and testing. CQ ... CQ ... CQ ... CQ ....

P.S. Continued research is now underway on a 10-meter, 10-ounce per hour version of this antenna, as well as a 12-element vertically stacked two-meter version complete with 10 drooping sections and buckets.

Depending on the mixture rate of research input and test antenna output, results may or may not be available by April 1st next year.

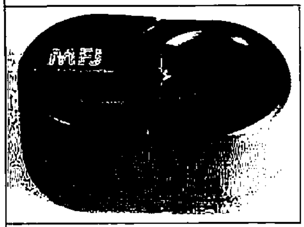
Number 72 on your Feedback card

New Products

NEW HAMTRONICS CATALOG

Hamtronics has recently published its 1998 catalog—40 pages of kits and wired units, including some new frequency-synthesized transmitter and receiver products, such as the T301 exciter and the R301 receiver. Hamtronics has also announced that they now stock two-meter and 220 MHz repeaters for next-day shipment.

You may have already received your new catalog. If not, write to Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535; call (716) 392-9430; FAX (716) 392-9420; or E-mail [jv@hamtronics.com]. While you're at it, ask for a complete catalog, which also includes all their VHF/UHF transmitters, receivers, repeaters, converters, preamps, and accessories—and let them know where you saw this announcement. You can also view the entire catalog at their Web site [http://www.hamtronics.com].

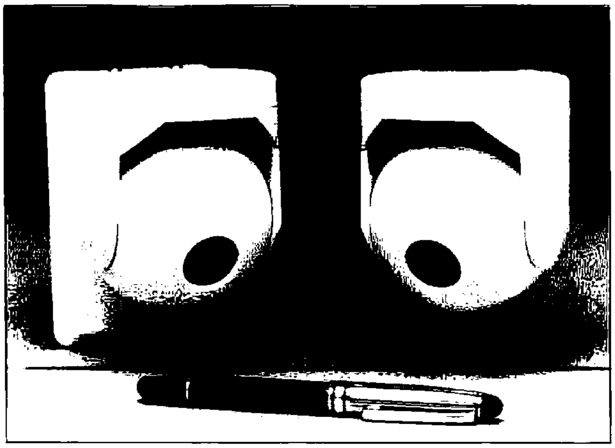


HOW DO YOU STOP A NICD FROM (OVER-) CHARGING?

MFJ Enterprises, Inc., is proud to announce the new MFJ-641 RapidBattery™ universal charger. It'll do both quick- and trickle-charging and will charge NiCd or NiMH battery packs. Charging status LEDs let you know when your battery is fully charged and microprocessor charging control technology stops the charging circuit when fully charged, avoiding overcharging and prolonging the life of your battery.

The palm-sized MFJ-641 uses universal interchangeable charging slots for drop-in charging. It comes with your choice of one charger slot; you buy extra charging slots for your different radios for $12.95 each. The MFJ-641 itself only costs $49.95—and of course it's protected by MFJ's famous No Matter What™ one-year limited warranty.

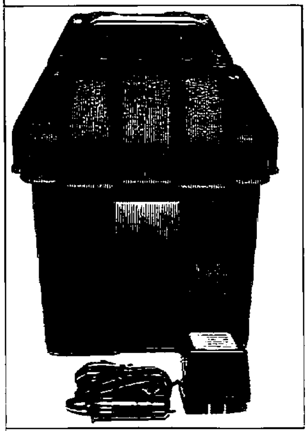
To order, or for the name of your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or explore the Web site at [http//www.mfjenterprises.com].



I DON'T KNOW, MURGATROYD ... WHAT DO *YOU* THINK IT WANTS?

Seriously, it's the next generation of ball cameras from the surveillance-with-style folks at CCTV Corp.: the new black and white BC-450 and the color BC-935C. The pen in the photo is so you can see how small these new guys are—just over three inches in diameter! They swivel 350° horizontally and can be positioned plus or minus 90° vertically to cover angles other ball cameras can't. These discreet cameras come with an easy wall mount that can fit right over a single-gang electrical box for fast prewiring. Both models come with 4 mm lenses but others are optional, as is audio capability. They're stylish enough to pass unnoticed in most interiors but made to be weatherproof, too. They can be used outdoors in temperatures ranging from -10° to 140° F.

For more information, get in touch with CCTV Corp., 280 Huyler Street, South Hackensack NJ 07606. Try calling them at (800) 221-2240 or FAX them at (201) 489-0111.



NO INTERRUPTIONS

The PowerPort PowerSafe, by Cutting Edge Enterprises, has everything you need for a 75- to 200-amp uninterrupted power supply—except a 12 V automotive battery. Choose from three models for light, medium or heavy use (we know which we'd pick, after the last few months!). All come with a heavy-duty vented battery enclosure usable in the home, triple-port automobile cigarette outlets for DC, and fully automatic chargers. The Deluxe model also provides 500 W peak AC power (300 W continuous), and the whole works is compact enough to fit under your desk—it's only 18 inches high. During emergencies, or in daily use, whether you're at home or in the field, this snappy Darth Vaderish unit will keep you operating with full power. DC models range from $66 to $168, the Deluxe AC/DC model is $230—and folks here in the Northeast would have been thrilled to pay it during last winter's devastating ice storms!

To order, or for more information about these and other Cutting Edge products, contact Roger Hall at Cutting Edge Enterprises, 1803 Mission Street, Suite #546, Santa Cruz CA 95060. Call toll-free (800) 206-0115 or E-mail [cutedgent@aol.com] and don't forget to tell them where you saw this!

IT'S COMING BACK!

Due to popular demand, Kenwood is bringing back the TM-541A. Many customers have expressed interest—and Kenwood listened! If you were familiar with the TM-541A, you already know about the 1.2 GHz single-band transceiver, the maximum 10 W RF output, the 20 multi-function memory channels, multi-scan capability—and all the rest of the great features! Hang around at your dealer's until you can get a new one of your own.

Your new product announcement could be here! Contact Joyce Sawtelle at 1-800-274-7373, or send good photo and information to *73 Magazine*, 70 Route 202 North, Peterborough NH 03458.

Number 74 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey. M.D. WA3AJR
P.O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Last month, we had a look at a high-tech tool to help the RTTY ham, a CD-ROM from Joerg Klingenfuss with all kinds of RTTY frequency data. This month, a different tool to use to get around the spectrum. Stan Wilson AKØB had been visiting the RTTY Loop Web site, and said, "I have noticed that it is hard to locate stations using Baudot on the HF ham bands. Do you know of any frequencies that would be good ones to monitor?"

And David Kent K4UJA asked, "I recently decided to monitor RTTY, out of my general interest in both VHF/UHF packet and satellite data communication. I purchased Brian Beezley's excellent program RiTTY2.0 and I'm impressed by its ease and efficiency when I locate a signal and that's the reason I'm sending this message. Where are the signals? I spent some time looking through the Library section of the RTTY Loop Web page hoping to find some mention of RTTY/PACTOR active sections of the spectrum but so far I haven't run across any. I don't mean for you to provide them to me but I would appreciate some guidance to articles, columns or links that may provide specific frequency groups to monitor for HF digital traffic, amateur, commercial, news, etc. ..."

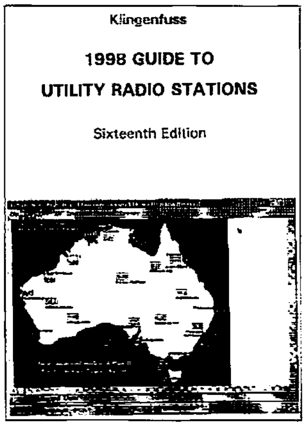


Fig. 1. Klingenfuss Publications' 1998 Guide To Utility Radio Stations.

Of course, ham stations are still commonly heard around 3620 kHz and 14.080 MHz. On the other hand, if it's commercial or governmental stations that you are after, *Klingenfuss' 1998 Guide To Utility Radio Stations* is the latest edition of this amazing compilation of digital frequency data. Within its 560 pages, you will find almost 12,000 frequency listings for some 2,000 stations.

Whether you are looking for a radio beacon or a PACTOR station, you are likely to find it here. With over 8000 changes since the last edition, this is a ready reference for the digital spectrum. The *Guide* is available for 80 DM from Klingenfuss Publications, Hagenloher Str. 14, D-72070 Tuebingen, Germany.

You could also E-mail them at [klingenfuss@compuserve.com], or check the information on their Web site at: [http://ourworld.compuserve.com/homepages/Klingenfuss/]. Whatever you do, be sure to mention "RTTY Loop" when you call, OK?

Regards to Ralston Gober, D.D.S. W5ZNN, a long-time reader of the column, who says he is "... going back into RTTY again for the umpteenth time. I will not bore you too long since you have probably been at it longer than I. *However*, I started with an old Kleinschmidt Clunker, and went to the Model 14, and up the line to the computer."

Among his accomplishments, Ralston includes news of his children and grandchildren, and the fact that he has been mayor of Corsicana, Texas. And I thought *I* was busy!

Gary Rogers WR7L, of Kennesaw, Georgia, passes along his regards as well. An old-time enthusiast of Baudot RTTY mode, he spends his days working for Turner Broadcasting in the Entertainment division. Another ham whose interest in RTTY has been rekindled, he says "I obtained my license in 1964 at the age of 14. I had my first Model 15 at age 16. I still have a Model 28 ASR at home and can punch out the old tape and receive on my ST-6 Demod. I have been off the air for quite a while in the RTTY mode, but your article has caused me to get the station back together again. I'm working on it right now to get it going so I will soon be on the air again. Does anyone sell the Reperf tapes any more? Or parts for the old machines? Are there any RTTY Nets around any more? Are there any associations left that specialize in RTTY? Just wanted to let you know that you're not alone when it comes to smelling oil and hearing the mechanical melodies of the teletype in the ham shack. I for one want to be on your team to keep RTTY alive and well."

Well, as we discussed a few months ago, there are several sources for radio teletype parts, including Typetronics, among others. Keep on trucking, Gary, and let us hear about your progress on RTTY.

Progress can be measured in many ways. Mike Stapp KEØWW, of Minneapolis, boasts that during the recent ARRL RTTY Roundup, he ran "QRP from a Kenwood TS-450, dipole, MFJ TNC and LAN-Link software. Got 57 QSOs, 30 states, five Canadian provinces, and HH2 for DX. Ran five watts most of the time but occasionally down to three watts :-). Fun!!!"

So, can it be done?

Manuel Martins CU3FM passes along a problem, though. He writes: "I have an FT-840 and an MFJ 12178B TNC. I am getting tired of trying to do RTTY with Multicom for Windows® and getting just a bunch of garbled letters, numbers, and symbols, nothing understandable. Do you guys know any trick to get this thing working properly on RTTY? I already did HF packet, why not RTTY?"

OK, folks, can anyone help Manuel? Pass it along to me for inclusion in a future column.

Thanks to Michael Trowbridge KA4RRU, who says that he still has a VIC-20 and AIR-1, in duplicate. He just can't help himself at hamfests! Thanks for the words of good wishes on the more-than-21-year run of RTTY Loop.

Dale Braun WD9GWH is another vintage teleprinter enthusiast. He is curious about what activity there might be nationally concerning using vintage teletype equipment. "I've had lots of fun lately using a Model 19 teletype, even using it in the latest RTTY Roundup contest, making 85 contacts."

Watch here for more information on Internet sites and the like for those of us who have never grown up!

Several folks have mentioned the "RTTY Loop" home page at [http://www2.ari.net/ajr/rtty/] and have found information either there or through the page. There is also an index to the RTTY Loop Software Collection, which continues to grow at a regular pace. Check it out, and send me your comments and questions at the above E-mail or snailmail address. I always look forward to your comments. No foolin'! 73

QRP

Low Power Operation

Mike Bryce WB8VGE
SunLight Energy Systems
955 Manchester Avenue SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Operating QRP while portable is a rewarding pastime for me. Even if it's nothing more than setting up the rig on the back deck, it's a lot of fun. Of course, operating portable means battery power. Yes, I've talked about this before—but many a QRP operator runs his entire station from battery power. Unless you're really, really into low power, a small battery just will not keep up with an active operator. A bit more bang is needed to keep your station up and running for the long haul.

Since I've yet to get the solar arrays and battery bank reassembled, all operating has been with midsized sealed lead-acid batteries. My largest unit has a capacity of 32 amp/hrs. Looking into the future, the solar array will be about 2.5 kWp and will have an operating voltage of 48 volts DC. All stored energy will be converted to 110/220 volts AC for use by the home. In the shack, this now converted power would again have to be downconverted to 12 volts DC. Yes, I could use a high-current DC-to-DC converter. In the back of my mind, I worry about RFI being generated by the converter. So, the use of large-capacity sealed lead-acid batteries in my shack may prove to be the norm.

An experimental high-current sealed battery charger

While it's more than possible to completely recharge a battery with just a trickle of current, the length of time required is a disadvantage. Using a high-current supply is another problem. A completely discharged battery will draw as much current as it can handle, usually exceeding the maximum current allowed by the battery. In extreme cases, it's possible for the battery to actually explode during an uncontrolled high current charge. Now I don't know about you, but something like that would completely ruin my day!

Sealed lead-acid batteries are a unique breed. While they operate just like their flooded-cell brothers, they require a more controlled charge scheme. They are sealed, yet the batteries must vent to release pressure during heavy charging—but you don't want to vent the batteries too much, as that dries out the gelled electrolyte. (The venting does not cause the drying effect; it's the overcurrent during recharging that displaces the water in the gel, causing the vents to pop.)

Sealed batteries are used as standby power sources, such as emergency lighting; or cycle use, with a discharge/recharge cycle every other day. In my case, my batteries are cycled every few days. The charger must be able to recharge the battery in the quickest amount of time, but without damage. The charger must also prevent damage to the battery once the battery has been recharged. Putting back the 90 percent charge is easy—it's that remaining 10 percent that's tricky.

The circuit

I've been working on this circuit for the past several months. Nothing is carved in stone, so you are encouraged to change or expand on my design.

Here's how it works. I used a transformer with a current capacity of six amps. This gives me plenty of room to expand and allows the transformer to operate cooler. A bridge rectifier and a capacitor form the basis of a simple power supply. Since this is a charger and not a supply, the input filter cap value is rather low.

An LM317 three terminal adjustable regulator is used as the primary voltage source. With a 5 k trimmer resistor in the adjust lead, the LM317's output voltage has a range of between 10 and 20 volts. The output of the LM317 drives an NPN driver, a 2N3055, which in turn provides base drive for another 2N3055. The LM317's adj trimmer sets the output of the last 2N3055 for roughly 15–17 volts. This section of the charger makes up the bulk of the current source.

An NPN transistor, a 2N4401, is connected to the adj line of the LM317. Base drive for this guy is provided by one section of an LM324 op amp. This one section of the op amp is configured as a voltage comparator.

In the negative lead of the battery, a 0.1 ohm five-watt resistor provides a 100-mV drop for each amp of current flowing into the battery. The resulting voltage generated by the resistor is fed into the op amp. A 7808 regulator provides a reference voltage source. Three resistors form a simple voltage divider, with the trimmer resistor setting the actual output of the divider. This is the reference voltage used to compare the voltage drop generated by the current sensing resistor. Remember, for each amp flowing through the 0.1 ohm resistor it will drop 100 mV. Our voltage divider may be set from 1 volt (10 amps) to 100 mV (1 amp) and just about any place in between.

Continued

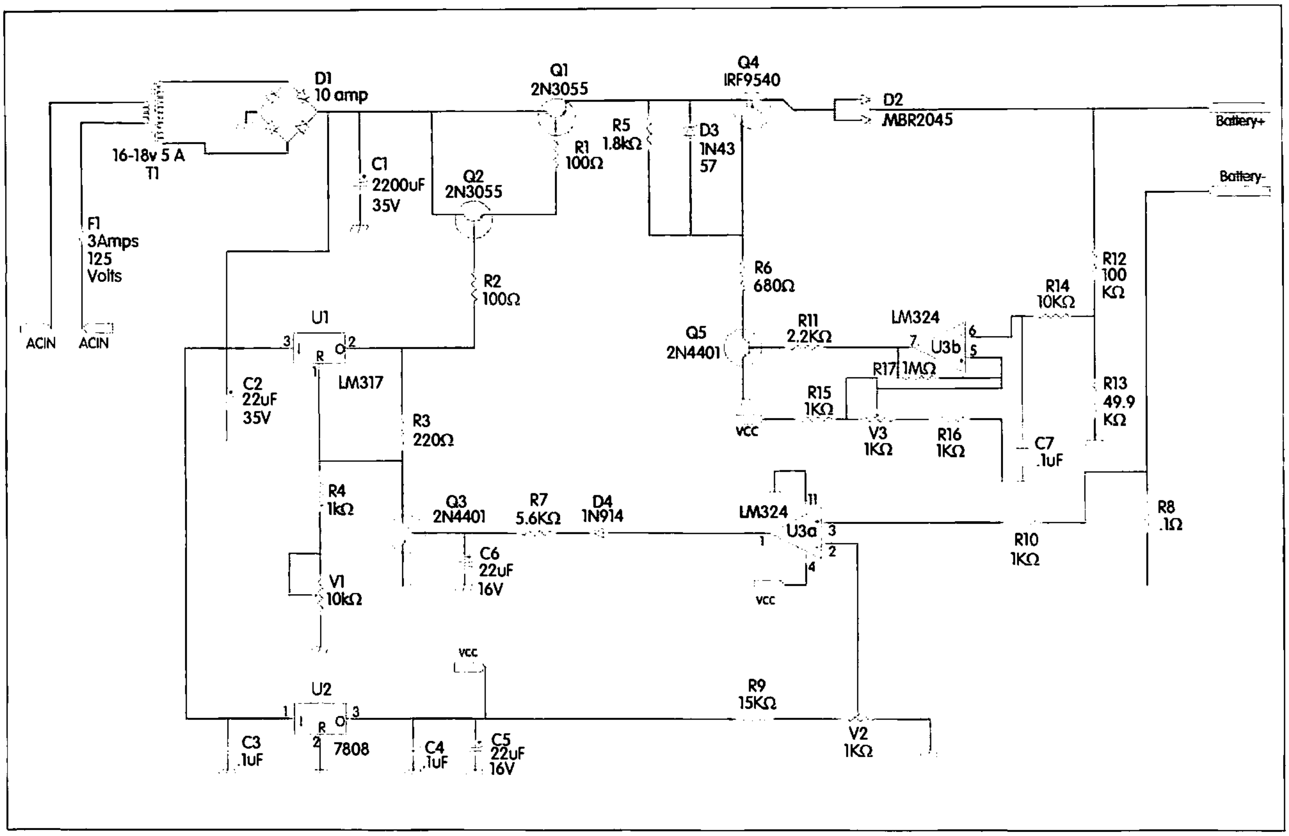


***Fig. 1.** Schematic for WB8VGE's charger.*

If we set the trimmer to provide 250 mV to the comparator, we have set the current limit at 2.5 amps.

As long as the current flowing is less than 2.5 amps into the battery, the output of the op amp is low. On the other hand, if the current flow exceeds 2.5 amps, the output goes high. This causes Q3 to conduct, pulling the adj line low. With the adj line low, the output from the LM317 goes to zero volts. With the output now zero, the current also drops to zero. This of course will cause the output of the op amp to go low, shutting down Q3 and allowing the output of the LM317 to once again go to 15 volts. Current over 2.5 amps is then allowed to flow for a split second and the whole process repeats at lightning rate. With the values shown (and the current limit trimmer set for 250 mV), the current will limit at 2.5 amps due to the rapid switching of the LM317 voltage source.

To slow down the pulses, and thus reduce the duty cycle on Q2, I added a 22 µF capacitor and a 5.6 k resistor in Q3's base lead. When the op amp switches states, the cap is quickly charged. When the op amp switches back to a low state, Q3 is held on for a bit longer, until the charge on the cap is drained down. This keeps the LM317 off a bit longer, allowing Q2 to cool during current limiting.

I chose the 2.5 A current limit because that's the maximum current my Power-Sonic™ battery recommends. The supply is capable of over four amps of current, but most batteries under 100 amp/hrs require much less. Always follow the guidelines provided by the battery manufacturer.

While the above description provides for current limiting, I needed to add a section to provide a constant voltage setting. Using another section of the op amp again configured as a voltage comparator does this. This time, we compare the battery's terminal voltage to a reference voltage supplied by the 7808 regulator. A simple resistive divider does all the magic. Two resistors also divide battery terminal voltage. A 20 k trimmer allows for fine tuning the divider.

With the op amp section configured as shown, we can generate a PWM output. This PWM is routed to an NPN transistor. As long as the battery voltage is below the set point of our reference voltage, the output of the comparator will be high. When the transistor conducts, it pulls the gate of the "P" channel power MOSFET to ground, allowing current to flow into the battery via a blocking diode. I added this diode to prevent reverse current flow in the event you power down the charger while a battery is still connected. When the battery terminal voltage increases to the shutoff voltage, the comparator switches states. This turns off the NPN transistor and thus the "P" power MOSFET. All charging current stops. Of course, the battery terminal voltage drops instantly when the charging current stops flowing. When the terminal voltage drops, that causes the FET to once again turn on and the cycle starts once more. In effect, the power MOSFET rapidly switches on and off at a duty cycle set by the battery. What you end up with is a poor man's pulsewidth modulation.

I built the prototype on perfboard. I recommend that you do the same if you plan to duplicate this circuit. As I refine the circuit, perhaps a printed circuit board will be designed, but for right now, perfboard is your best bet.

The power MOSFET must be on a heat sink. It will get hot. "P" channel MOSFETs do not have as low RDS on as "N" channel MOSFETs. However, that is changing. In fact, you can get some "P" channel MOSFETs with RDS on matching those of

Continued on page 77

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/
homingin/]

Build the Montreal Fox Controller

Have you started building your foxboxes yet? Last month's "Homing In" showed you how obsolete business-band transceivers, discarded medical batteries, and military surplus ammunition boxes can slash the cost of making transmitters for international-style radio-orienteering (also called foxtailing and ARDF). Now you can save some serious cash on the control circuits, thanks to two generous hams in Montreal.

A controller board is the brains of a fox transmitter. For radio direction finding (RDF) contests under International Amateur Radio Union (IARU) rules, it makes the fox transmit for exactly one minute at its correct point in the sequence of five transmitters. It generates the appropriate CW message (e.g., MOE for fox #1) throughout the transmission and the station callsign at the end. Delayed starting and automatic shutoff after the hunt are other desirable controller features.

In 1970, I built my first solid-state CW callsign generator for a UHF repeater. It was a big improvement over a mechanical code wheel. It didn't seem like a big drawback that it had 20 discrete transistors and 80 diodes and required almost a square foot of perforated board to hold everything. If I hadn't spent several hours manipulating logic maps of the dits and dahs in my callsign, it would have taken over 200 diodes. Today, one IC and a handful of other parts will do all that, plus provide transmitter control and timing to meet IARU rules.

One-chip microcontrollers using reduced-instruction-set architecture are revolutionizing the design of logic circuits. CMOS technology minimizes current drain, while EEPROM or flash memories retain data through power-off periods and permit simple reprogramming in the field. Peripheral Interface Controllers (PICs) by Microchip Technology Incorporated are among the most popular microcontrollers for amateur radio home construction projects.

When I visited Montreal last October, I was shown a nifty little PIC controller for mobile T-hunts. I encouraged its developers (Jacques Brodeur VE2JX and François Tremblay VE2EMM) to make a special version for IARU radio-orienteering standards. They soon did just that. By eliminating the DTMF controlling/programming feature, it became a simple one-IC project. Raw parts cost for five controllers is about $15 each, not including shipping, circuit board, and programming of the PIC.

Two controllers in one

The Montreal Fox Controller uses a 16F84 reprogrammable PIC with nonvolatile flash memory. An inexpensive 4.194304 MHz microprocessor crystal (X1) provides timing accuracy and synchronization through long hunts, with about one second variation in six hours. The MCW output is a keyed tone to drive the mike input of a two-meter FM rig. The CW output is an open-collector pulldown for on-off keying of an A1 transmitter per IARU rules on 80-meter foxhunts.

MOx messages are sent in slow code, but station ID is sent at about 20 WPM, to avoid hunters confusing the callsign with the fox number. You can put out your foxes in advance and have them come on automatically at hunt time. Delayed startup is programmed with DIP switches in 30-minute increments from zero to three-and-a-half hours.

Fig. 1 is the complete schematic of the Montreal Fox Controller. Most of the parts should be locally available. Digi-Key Corporation [701 Brooks Avenue South, P.O. Box 677, Thief River Falls MN 56701; (800) 344-4539] carries all components, including the unprogrammed PIC IC.

VE2JX and VE2EMM are making the PIC program for this project available to all hams for ARDF and other noncommercial purposes. They don't want to go into the circuit board or parts business right now, so I am arranging for circuit boards to be sold by FAR Circuits [18N640 Field Court, Dundee IL 60118; (847) 836-9148]. As of this writing, the FAR boards are not yet fully checked out and ready to go. There may be additional sources of boards in Canada and Australia by the time you read this.

My original plan was to include all the circuit board and programmed PIC sources in this article. However, the development of this project was slowed greatly by the monstrous ice storm that struck Montreal in early January. "Four inches of ice formed on everything," Jacques wrote when his Internet access resumed. "Just imagine the weight! The downtown Montreal area was closed for removing the ice on the tall buildings—it was falling on the people. Hundreds of pylons for the transport power lines are down, tens of thousands of poles are broken, and the distribution network is so damaged that they say it cannot be repaired. It will have to be rebuilt to new completely. People could not use their cars, because the streets were littered with poles, trees, and electric lines. All business, industry and farming in the area stopped. Cows were dying, many farmers could not milk them."

As I write this two weeks later, 250,000 homes are still without power in the Montreal area. Not surprisingly, François and Jacques have been busy with emergency communications and their ham projects have been on hold. So check the "Homing In" Web site, where you will find an up-to-date list of sources for circuit boards and

QRP

continued from page 76

the "N" channel, but they are expensive and hard to obtain.

A heat sink will also be required on the 2N3055 pass transistor. If you intend to use an encapsulated bridge rectifier, it too will need a heat sink. Other than that, there are no restrictions on construction. Use of an IC socket would be a good idea for the LM324.

Changes in the wind

I really don't like to place a current shunt in the negative lead. It is cheap and dirty, but requires the negative side of the charger to float. The battery negative may be grounded if you desire. If the shunt resistor were to be placed in the positive side, a separate supply would be necessary to run the op amp.

I may change the way the current limiting operates. By controlling the FET via the current limiting op amp, we could eliminate the PWM from the LM317. I've not looked at the spec sheets for the LM317, so really can't say for sure if running the adj line on and off will damage the LM317.

As I mentioned in the first part of the column, this project is just a starting point. Refinements will be necessary to suit your needs, as well as mine. I'll keep you posted on any changes that I've worked into the charger.

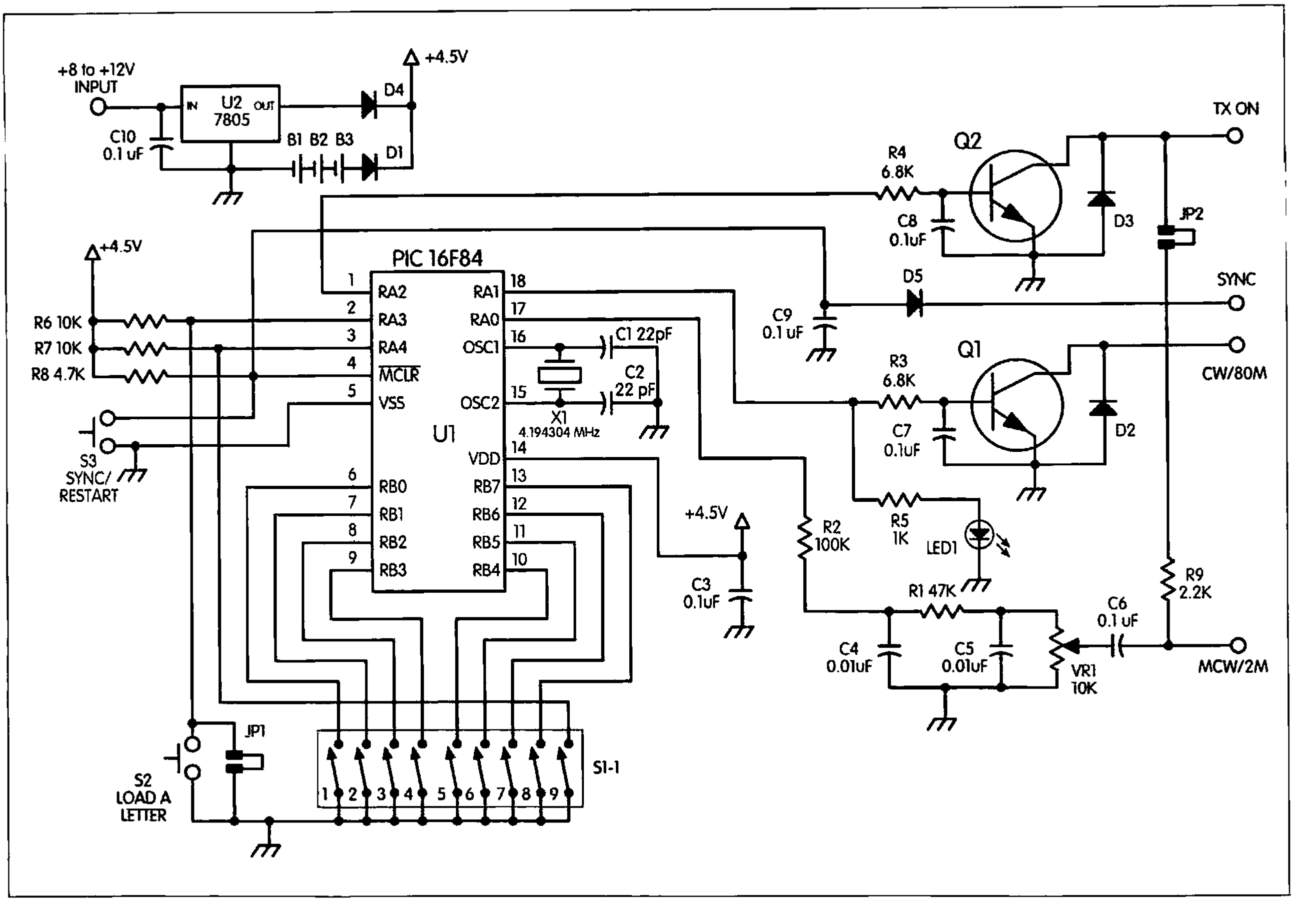


Fig. 1. Schematic diagram of the Montreal Fox Controller. Unless otherwise indicated, resistances are in ohms, decimal capacitances are in microfarads, and diodes are silicon signal types such as 1N4148. Transistors are common switching types such as 2N2222A.

preprogrammed PICs for this project. At this site you will also find the source code and hex files for the firmware, which you can use to program your own PICs. The source code file includes the table of values for CW characters that you will use to change the callsign in the field.

If you do not have Web access, send E-mail to me and I will send you the files via return E-mail. If you are not E-mail or Web-equipped, send me a five-inch by seven-inch self-addressed stamped envelope with three ounces of postage and I will send you hard copies. If you get the program via postal mail, you will have to enter it by hand from the hard copy, a rather tedious task.

You may discover, as I did, that it's useful to have the capability of assembling PIC micro code and programming PICs yourself. Microchip [2355 West Chandler Boulevard, Chandler AZ 85224; (602) 786-7200] has a full line of development tools and software for programming PICs and debugging micro code including SPASM, a freeware DOS assembler program. Several other companies also make such tools. Plans for building your own PIC programmer from scratch can be found on the Internet.

For programming my PICs, I chose the PIC-1+ from IT Technologies [3704 Cheviot Avenue, Suite 3, Cincinnati OH 45211; (513) 661-7523)]. It is available in kit form for $39, including power supply, DB-25 data cable, and DOS software. The old 286 computer next to my workbench runs it just fine. I recommend spending $9 more to get the 18-pin zero-insertion-force PIC socket. The PIC-1+ can program the Pica's program memory, set configuration fuses, verify programs, and read PIC memory to a file. Its software also performs data memory programming, reading of data memory, and bulk erasing of EEPROM-based PICs. Links to Microchip, IT and the freeware PIC programmer are at the "Homing In" Web site.

Perforated board construction is fine for this project, as **Photo A** shows. High frequencies are present only near X1, C1, and C2. Keep the leads of these components short and place them close to the PIC. Put C3 near U1 with short leads to provide good high frequency bypassing. Be sure to use a socket on U1 to facilitate any firmware changes or upgrades.

S1 is a nine-section DIP switch. VE2JX suggests marking it backwards on the board, with S1-9 on the left. This places the least significant bits of each function on the right, the normal convention. An open switch section represents a logic 1; a closed switch is a logic zero. I discovered the hard way, as did Jacques, that surplus rocker-style DIP switches can have high enough contact resistance to make callsign and function programming unreliable. Look for high quality slide-type DIP switches with gold-plated contacts.

Keying transistors Q1 and Q2 are pulldowns for transmitter keying circuits requiring grounding of a positive voltage, as typical VHF/UHF mobile rigs do. With JP2 in place, the MCW/2m output provides both keying and audio to most handie-talkies. If your radio requires keying current greater than 40 milliamperes like some older mobile sets, you may need to change the

value of R4 and/or provide a beefier transistor at Q2. The same is true of R3 and Q1 on the CW/80m output. The RA1 and RA2 outputs of the 16F84 will source up to 20 mA.

François and Jacques added several components for "insurance" purposes. C7, C8, and C9 prevent problems from spikes and noise, so they may not be mandatory in your application. D2 and D3 protect Q1 and Q2 from the inductive kick of relays and are needed only if your transmitter has them. If you will use your controllers only on two meters with MCW audio, you can delete R4, C8, Q2 and D3. Conversely, if your unit is only for an 80-meter CW fox, leave out R1, R2, R4, R9, C4, C5, C6, C8, Q2, D3, VR1, and JP2.

U2, D4, and C10 are optional. Maximum current drain of the PIC circuit is only eight milliamperes, half of which is indicator LED1. Three AAA alkaline batteries will power it for over 150 hours. U2 and associated components allow you to eliminate the batteries and power the board from the same +8 to +14 V source that powers your fox transmitter. Remember that any power interruption resets all the PIC timers, so don't disconnect power after you synchronize the foxes for a hunt. Using batteries in addition to the regulator provides backup to carry the timer through any external power interruptions. Schottky diodes D1 and D4 (1N5817) prevent the batteries and regulator from damaging one another.

Ready to test?

Before installing the PIC in its socket, check your workmanship. Make resistance measurements to verify that one terminal of each push-button and DIP switch section is connected to circuit ground. Close all DIP switches and jumper JP1. The emitter of each transistor and pins 2, 5, 6, 7, 8, 9, 10, 11, 12, and 13 of U1 should show continuity to ground. If you included regulator U2, apply +12 volts to the input and verify +5 volts at the output. With JP1 removed and power applied from fresh batteries or U2, verify that about +4.8 volts is present at U1 pins 2, 3, 4, and 14, but not other pins.

If everything checks out OK, then remove power, install JP1, plug in U1, and try it out. Set the DIP switches for continuous cycling, fox #1, and zero delay per **Table 1**. Apply power, press SYNC/RESTART (S3), and view LED1 to verify that the unit sends MOE nine times in slow CW, then identifies rapidly as DE FOXBOX.

Besides flashing the CW characters, the LED provides other operational indications. During the delayed-start wait time, it flashes once per second. If you set the DIP switches for an improper combination, such as fox #5 cycling once every three minutes, it flashes rapidly to signal your error.

DIP switches S1-1 through S1-9 determine the fox number and message as shown in **Table 1**. In accordance with IARU regulations, fox #1 sends MOE continuously at about 8 words per minute. Fox #2 sends MOI, fox #3 sends MOS, and so forth. Even if you don't know CW, you can determine which fox you're hearing by counting the dits after MO (which is "dah-dah, dah-dah-dah").

The IARU does not prescribe the message for fox numbers greater than five. In the VE2JX design, fox #6 sends MON (ending in "dah-dit") and fox #7 sends MOD (ending in "dah-di-dit"). For foxtailing events in a very large park where contestants can get lost, there is usually a fox on a separate frequency sending MO continuously at the finish line, which is usually at the same place as the start. Such a mode is provided in this unit.

Pressing the SYNC/RESTART push-button (S3) with JP1 in place causes the microcontroller to read the octal code settings of S1 and commence operation in accordance with these settings. Press S3 when you power up, when you change modes, and when you begin a delayed start cycle. To operate a set of IARU-style foxes in sequence, set the DIP switches in each one to its unique fox number. The setting for number of foxes and start delay must be the same for each fox. Now press S3 on each unit simultaneously.

You don't have enough fingers? OK, connect the SYNC terminal on each unit together and short this connection to circuit return (ground) momentarily to perform the restart. Of course, the circuit returns of each board must also be connected together to do this. If you will be synchronizing several foxboxes regularly, make up a wire harness just for this operation.

Station identification remains in data memory when power is removed. Changing it from FOXBOX to your own callsign is a simple procedure. Monitor the CW tone output at RA0 (U1-17) with headphones or a speaker amplifier. (Computer speakers work well for this.) Alternately, you can watch the CW flashing of the LED. With power on, remove jumper JP1 and press SYNC/RESTART.

Continued on page 85

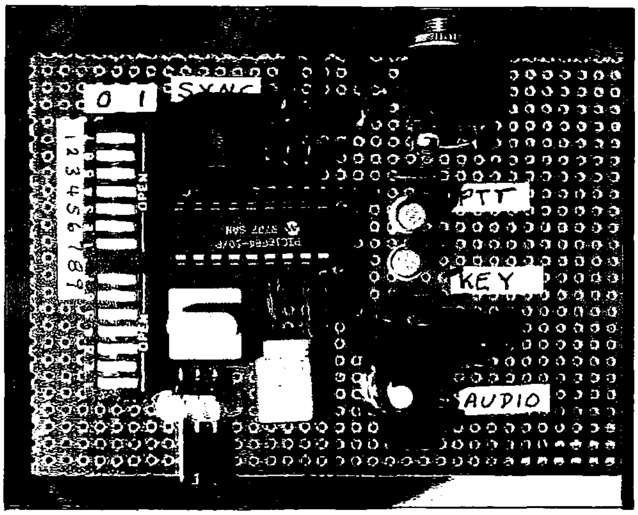


***Photo A.** Prototype of the Montreal Fox Controller on perforated circuit board. To facilitate program changes, be sure to provide a socket for the PIC.*

Setting	Cycle	Message	Delay
x,x,x	S1-9,8,7	S1-6,5,4	S1-3,2,1
0,0,0	Continuous	MO	None
0,0,1	Continuous	MOE	0:30
0,1,0	2 minutes	MOI	1:00
0,1,1	3 minutes	MOS	1:30
1,0,0	4 minutes	MOH	2:00
1,0,1	5 minutes	MO5	2:30
1,1,0	6 minutes	MON	3:00
1,1,1	7 minutes	MOD	3:30

***Table 1.** DIP switch settings for transmit cycle, fox message, and start delay.*

Millen-Dollar

continued from page 49

utilized. If it remains exposed, it is a potential shock hazard.

Fortuitously, I had a short length of blunt-ended shrink tubing in the shack. I dressed it for length, snipped off (like a cigar) a small opening in the end, and slipped it into place. This allowed the rear lug to push through for subsequent soldering (see **Photo C**). I exposed the shrink tubing to a little stovetop heat to complete this task.

In very high voltage applications, you may want to further insulate the completed disconnect module from ground with a piece of Plexiglas. Prepare a small right angle bracket (**Photo D**) and mount the disconnect to the insulating material through a one-half-inch drilled hole. If you require a through-chassis mount assembly, cut an opening in the deck approximately one and three-quarters inches square. Drill a half-inch hole in the center of a piece of insulating material measuring about two and one-quarter inches square to accept the fused disconnect.

Center the modified fuseholder in the chassis opening and drill through the chassis and insulating material to accept some nut/bolt mounting hardware. The added distance to chassis ground afforded by the insulating material will insure against any possibility of arcing to chassis ground (**Photo E**).

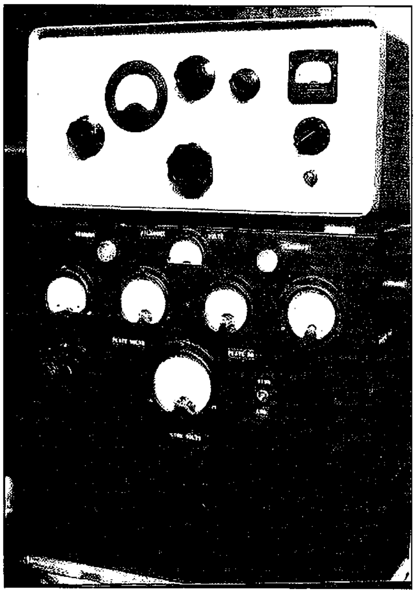


Photo F. *The completed RF deck resting comfortably above a circa-1964 power supply. All voltages originate from the lower unit and must be cabled to the RF deck via quick disconnect assemblies.*

The rest's a snap!

Solder the far end of the HV wire to the DC output source within the power supply. If your installation requires the wire to pass through the chassis, use a grommeted hole to protect from chafing and to avoid the possibility of short circuiting. On the RF deck, wire up a length of HV wire from the solder tab at the rear of the fuseholder to the base of the HV plate choke.

Route the wire to avoid any possibility of short circuiting, and (plastic) clamp it along its length to avoid movement. Use any remaining epoxy (or silicone seal if you prefer) to build up an insulating shield over the rear tab to eliminate the possibility of an accidental jolt from the exposed HV potential.

It may be a good idea to add a bit of additional insurance against any accidents should the high voltage wire somehow pull out because of some inadvertent tug on that line. Secure the HV lead with a plastic strain insulator clamp attached to the chassis and positioned as close as practical to the input of the fused disconnect. It's clear sailing from there on in. Give it a try. It's a safe, economical, foolproof, and convenient disconnect method for a vitally important aspect of an amplifier construction project. 73

Never say die

continued from page 5

Big corporations tend to play it safe. They wait for entrepreneurial companies to develop new technologies and then they buy or steal them. More the latter. But their interest is in getting their investment back as quickly as they can, so they tend to go with well proven technologies and charge top gouge price for their product. They've found they can make up with advertising what they lack in technology. For three, the more they have to pay for a channel, the more they're going to charge us to use it, so the bottom line is simple: all these billions are going to eventually come from our pockets in higher costs for the products and services we buy.

Gee, what a surprise!

The old FCC approach of holding hearings to determine the best use of frequency allocations had its drawbacks too. But then one would be hard put to point to any government bureau that is not screwing things up more than they are benefiting us.

Hamfest Scams

Well, they're scams for the ham industry, not the attendees. This is what went through my mind as I looked over the usual stack of requests for prizes and ads in hamfest programs. Sigh. Look, guys, I've been exhibiting at hamfests and ham conventions for 43 years, so there are a lot of things that I've learned — mostly the hard, expensive way.

Prizes, for instance. As an attendee my chances of winning anything substantial in a prize is squat. Maybe a gift-certificate discount for something I'm not interested in. As a manufacturer, what do I get out of being a good guy? With some luck, I'll get a "Good Guy" certificate. Period. Yeah, my company will be listed in the hamfest program as a donor. Big deal.

If they want prizes to raffle off or give away I'll be glad to sell 'em to the hamfest prize chairman at my lowest discount price.

If I donate something that the attendee wants, then I've lost a good potential sale. If he doesn't want it, I've wasted my money.

Now, about that big listing in the program. That's about as valuable as running an ad in the program. I tried that for several years. I ran ads for *73* in lots of hamfest programs and never got one single subscription as a result. Not one! I tried all kinds of ads. I tried special prices. I tried chatty ads. Nothing pulled. Finally the light dawned. Nobody ever looks at a hamfest program. They pick 'em up because they're free and take 'em home, where they go up on the shelf. A few years later they go out with the trash. Or they end up in the attic in a box, if the ham is a compulsive collector. Like me.

I used to donate gift subscriptions to the Dayton hamvention®. The organizers were kind enough to provide a sign for my booth saying I was a prize donor. The result of that was about 2,000 hams passing my booth saying they were going to wait and see if they won the subscription. I'll bet I lost a thousand dollars in subscriptions as a result of giving a few freebies away.

In retrospect I might have tried to work this to my advantage by making

the prize bigger — like a lifetime subscription — but valid *only* if the chap had bought a subscription before winning the prize.

Hamfests, if they're going to distribute programs, have to sell ads to help pay for the printing. A few posters around the hamfest area showing the program would do the job and save an awful lot of wasted money.

Why don't hams read the programs? Because there's hardly ever anything of even the slightest interest in 'em. Boring. There's no good reason to look at it.

Of course, if hamfests could recruit some really interesting speakers and get them to contribute a paper to be published in the program, that might help. I don't think I've ever been asked for anything like that.

Interesting speakers? How many hamfest speakers do you remember who were fun to listen to? My only memory was Jean Shepherd K2ORS, who was fabulous. I'll bet Barry Goldwater K7UGA, King Hussein JY1, or Art Bell W6OBB would draw a crowd. How about movie producer Dave Bell W6AQ?

Global Warming Crapola

If you listen to the politicians, the man-made CO_2 gases are accelerating the warming of the Earth. If you listen to the scientists who are experts in this field they say this is a bunch of baloney. Yes, the Earth has been in a warming period that started 300 years ago, long before Ford popularized the internal combustion engine.

Gore says that "CO_2 and temperature have gone up and down in lockstep." The temperature record for the past 3,000 years shows that the atmosphere during two-thirds of those years was warmer than it is today, with five distinct warm eras. Yet, during all of those warm periods, CO_2 was lower than today. Gore is wrong!

So, based on political, not scientific, rhetoric, Clinton is signing the treaty to limit CO_2 emissions. And what effect will this have? The US Department of Energy has predicted that this will cause a 20% drop in steel production and close down all US primary aluminum plants. These huge industries will have to move to countries that are not signatories to the treaty, such as Mexico and China. The global emissions will be unchanged, we'll have just forced several billion dollars' worth of industries to move out of the US — taking with them all the jobs involved. And all of this is happening because the Democrats have whipped up a lot of fake excitement over the environment, aimed at getting Gore elected president in a couple of years. Why am I reminded of the movie, *Wag the Dog*?

The scientific facts do more to support Robert Felix's *Not By Fire, But By Ice*, even if they don't agree with the Clinton political agenda. A letter from Geologist Jack Sauers points out that the data from across the northern tier states from Washington to North Dakota shows that temperatures since 1940 have fallen lower than they were in 1890, when the "Little Ice Age" was experienced. This agrees with a similar drop in temperature in every Scandinavian country, also with rising precipitation. It agrees with satellite and radiosonde temperature data. It agrees with tree ring thickness from the Arizona Tree Ring Lab. It agrees with the tree ring density data from the western US and Europe, with the temperature high around 1940. The US Dept. of Agriculture Plant Hardiness Zone map shows a southern deflection of 10°F between 1960 and 1990 maps, which strongly affects plants. The Wildlife Department is reporting that huge numbers of moose have been coming down from Canada to Vermont, New Hampshire, upstate New York, and even Connecticut.

As with cold fusion, where theory and data are in disagreement, it's the theory that should give way, not the data.

So, what can *you* do? At the least, register an informed protest with your senators and congressman. Second, talk about this on the air and get others to protest this expensive Clinton political media management program.

Games

Your mind, as I've mentioned, is like a muscle — you either use it or lose it. Unfortunately, from what I've been hearing lately on 20 m, an awful lot of hams seem to have lost what little of their minds they maybe once had.

So I keep nudging you to check out some of the more interesting books I've found, and to take advantages of the learning that amateur radio makes possible, and fun. I'm afraid my words fall on blind eyes. "There goes that damned Never Say Die again, trying to get me to think."

Well, how about your kids? The average dad, according to surveys, spends about 15 minutes a week with his children. If you

have any interest at all in your children growing up able to reason for themselves instead of meekly being pushed around by peer pressure (a.k.a. mob psychology) and the media, then start early playing games with them. I recommend you go more for thinking games rather than games of chance.

Chess, as I've mentioned in the past, is a great game in that it is pure strategy and is much like both life and business in many ways. When I was a kid I enjoyed Peggity, Cubic and Battleship. Peggity has a board with a bunch of holes and the aim is to be the first to get five pegs in a row. That takes strategy. Planning. Cubic is like three dimensional tic-tac-toe, where you have to be the first to get four markers in a row in any direction.

There are a lot of good card games. One of the tougher card games is Russian Bank. You can consult Hoyle on how to play that, but it requires real concentration.

Monopoly® is okay, but it's too much a game of chance. Ditto most other board games. Anagrams is great because it really makes you think and helps to build your vocabulary. Another word game is Boggle®, which was invented by a good friend of mine. If you play it so you have to make words with four or more letters, it's a real challenge. Boggle is played with 16 dice, each with letters on it. You shake 'em up and they fall into a four by four grid. Then, with the clock running, you see how many words you can make using letters that are in contact with each other in any direction. It'll get you thinking and your kids too.

I'm almost addicted to crossword puzzles. I love 'em! They are a great challenge. And any newspaper cryptogram that I happen across I just have to do.

The more you can teach your children to think when they are young, the more their brains will grow during this important development period. This is a great gift of love you can give them. It may, too, also help you understand the little monsters better. As animal trainers have found, you can teach animals infinitely more through love and understanding than you can through fear and intimidation. I sure wish someone had taught my father that. Fortunately, my mother understood it.

Remember, if you find you "have" to spank your child, you have failed as a parent and a teacher. You are punishing your child for your failure and building more and more of a wall between the two of you, one that will last for life. The child will never again really trust you or believe in you.

As with children, if you are having any problems with animals or any other living things, the problem lies with you, not them. It's your attitude that has poisoned the relationship.

One of the best books I've read about all this is *Kinship of All Life* by J. Allen Boone [$9 from Dowsers; call (800) 711-9497]. Boone explains how he learned to communicate with all living things from a dog. His story of his adventure with a fly is most entertaining. Before reading this I'd always had problems with flies around the house in the summer. In the spring I'd get out the fly swatters and put one in every room. Then would come daily swatting sessions, particularly in the kitchen.

After reading the book I did what Boone said and had a man-to-fly conversation with the first fly that appeared in the kitchen. Then, instead of swatting it, I opened the screen and let it out. A couple more showed up a few days later and I had a similar discussion with them, and let them out too. It's been two or three years now and the fly swatters are all out in the barn somewhere. I've never had another fly come into the house — which I sort of regret, because I'd like to make friends with a fly.

And while you're at it, if you haven't bought *The Secret Life of Plants* yet, add another $16 for that one. This will help you to communicate with plants as well as animals and insects. These are both also available from Radio Bookstore: #5280 and #5300; (800) 243-1438.

Once you get the hang of it, get busy and teach your children how to do it. As Boone explains in a later book, you can use the same approach in dealing with people on a nonverbal level. You'll learn a whole lot more about them this way than just listening to what they're saying.

Flight 800

Yep, I've got more news about that flight. But if you've been listening to the Art Bell (W6OBB) show every night as I've recommended, you'd already know all about this. Art had Bill Donaldson on his show, a chap who's taken the data from the recovered flight recorder and analyzed it very carefully.

Bill explained that the last few seconds of recorded pressure readings could *only* have been produced by an external explosion. It couldn't possibly have been a fuel tank, as the NTSB has claimed. This also helps explain the testimony of scores of people who claim to have seen the trail of a missile heading for the plane just before the explosion.

Is this official bungling, or just one more government cover-up?

And is there any connection with the delay of the El Al flight which was scheduled to be in that time slot? Could the TWA flight have been mistaken for it?

More Dowsing

If, despite my editorials, you haven't yet looked into dowsing, you are, to say the least, curiosity-challenged or being held prisoner by procrastination. If you think that all this paranormal stuff is crap, then you are either ignorant of, or able to ignore, mountains of evidence. Yes, I know and agree that there are also mountains of tompoopery out there. But we have that also in our blessed scientific community, which is still, in the main, holding on to the Big Bang theory, despite conclusive evidence that it isn't true (which they refuse to look at). Including genius Hawking.

There have been endless scientific tests down through the years which have proved that dowsing really does work. For instance there was a test in 1913 in Paris. The test was to locate a series of quarries which had been dug under Paris since Roman times. The charts of these were unpublished and kept locked away. The tunnels and quarries were 16–20 meters underground. Dowsers proceeded to put stakes in the ground showing precisely the location of the underground tunnels and galleries, including one gallery that no one had known about, but which was discovered as a result of the dowsing.

Arthur Young wrote, "Experimental proof gathered to support the existence of a phenomenon does not guarantee that it will not be ignored or rejected. This is because there is no theory to account for it, and existing theories apparently rule out its reality."

This certainly has been the case with cold fusion, and no amount of confirming research reports have been able to sway the editors of major scientific journals.

But, when we admit the reality of dowsing, that opens the door to remote viewing and a lot of other paranormal realities — like how do animals find their masters thousands of miles away, and how do monarch butterflies know where to go in the winter?

Another book I'll have to add to my *Guide* is *Psychic Animals*, by Dennis Bardens, a truly fascinating book which has been published by Barnes & Noble. How do pets know when something is going to happen to their masters? How can they find them under incredible circumstances, like the dog, accidentally left behind by a ship's captain, who went aboard many ships for several days, finally found another ship heading to the same destination as his master,

and stowed away on it to get there — eventually finding him. How do pets know about earthquakes ahead of time?

Isn't it about time to start investigating what's going on so we can understand it and maybe even put it to some good use?

So, have you procrastinated about getting the Lehto book I've recommended? And Bird's *The Divining Hand*? Ross & Wright's *The Divining Mind* [$10.95 from Dowsers, (800) 711-9497] is a 130-page guide to dowsing. Yes, you, too, can learn this amazing and unexplainable art.

History

Art Bell had Captain Crunch on his show talking about the old Blue Box days and that reminded me of the time I published a bunch of telephone circuits in *73* (including the Blue Box) and got sued by Ma Bell. That's a helluva story. It was also responsible for Sherry and me getting together. Let me know if you'd like me to write about it.

Art mentioned that Steve Jobs and Steve Wozniak were making Blue Boxes before they started Apple™. How Apple computer got started and my role in all that is another story, but I don't know if you'd be interested in the inside history of Apple — the *real* history that I've never seen covered in any of the books or articles about Apple (except perhaps in some of my old editorials). I don't want to spend my time and your eyeballs on things of little interest to you.

I was also there when the first microcomputer was launched, which is another great story. The rise and fall of the Altair 8800 computer from MITS. Ditto the Sphere micro from Salt Lake City and the South West Tech micro from San Antonio. Or how the Radio Shack™ TRS-80 computer got started and why it died is another fascinating story. To me, anyway, and I knew all the people involved personally.

Another great story has to do with the Texas Instruments™ TI-44/a computer and how they managed to lose $630 million on the project instead of making billions, which was easily within their grasp. I was in the middle of that whole business too.

Then there's the story of how American Mensa got started. I was one of the five at the very first meeting back in 1960 and was the first secretary of the organization.

Somehow I've managed to be at the right place at the right time for a lot of interesting things. So let me know if any of this ancient history is of interest to you.

The Generals

Way back in 1955, shortly after I'd gotten Perry Ferrell, the old editor of *CQ*, a better job as editor of *Popular Electronics*, *CQ*'s publisher talked me into being the new editor. I'd been doing the RTTY column for *CQ* and also publishing a RTTY journal (*Amateur Radio Frontiers*) for several years, so the job offer wasn't completely out of the blue.

Part of the deal was the hiring of Jim Morrissett K2OLK as my assistant editor. I'd met Jim in 1950, when we were both at the Hubbard Dianetic Research Foundation in New Jersey. But that's another long story.

My first action as the new editor was to convince my old friend Sam Harris W1FZJ to sign on as the VHF editor. Jim and I drove up to Boston and stayed a weekend with Sam, cementing the deal. Sam had a psychological problem — he *had* to have the biggest signal in the world on any band he was on. As W8UKS in Cleveland he had a bi-square beam on 75 m and was running a Collins 32V. As I recall, it had about 50 watts output on AM. I was running a kW to a half-wave antenna in Brooklyn. When I'd try to break in on his contacts with South Africa the ZS would say he thought he could hear a slight heterodyne on Sam's signal. That was me. They'd then let me into the contact.

I eventually forced Sam to move to Puerto Rico so he could use the big dish at Arecibo. I did that by setting up my station on the highest mountain in southern New Hampshire and running a kilowatt (AM) to a 336-element beam on 2 m.

Our second action was to visit Dick Spenceley KV4AA, down on St. Thomas. Dick had been unhappy about Perry, who was not a ham, as the old editor. Jim and I had a great visit. We rented scuba gear from Leslie Caron's father, who ran a dive shop, and dove all around the island. Jim and I had a great time, eating locally-grown bananas, coconut, soursops, and sugar apples. But we noticed that the local people didn't seem much interested in this food, preferring to buy imported canned food. Dick explained that only poor people ate the local food, so as soon as anyone made any money they started buying imported food. And getting sick.

Societies which eat locally grown fruits and vegetables and haven't yet been introduced to refined sugar and white flour don't get cancer or have heart attacks or strokes. But when they shift to white rice and white flour, where the bran and germ has been removed, they can starve to death eating the stuff.

We are hit hundreds of times a day with food propaganda from the Generals — General Foods® and General Mills® — convincing us to eat their foods. So we dutifully buy TV dinners, white bread, white rice, boxed and canned foods, and drink billions of cans of soda and beer. We buy potato chips, corn chips, and pre-popped popcorn. We buy sugar-coated cereal. We buy what we acknowledge as junk food from McDonald's®, Dunkin' Donuts®, Pizza Hut®, and the good old Colonel.

The result is that 50% of us have heart attacks. This is a bonanza for the medical profession. They're performing over 400,000 bypass operations a year, knowing full well that 50% of the people will clog up again within five years.

So we have apple pie and ice cream as our national dish. The pie crust is soaked with saturated fat (lard or shortening). The filling has some very dead apples soaked in a congealed sugar goo. And the ice cream is made of fat and sugar. *Bon appétit!*

It's sugar, white flour, and other refined and processed foods which are making us sick and killing us years ahead of our time. They're the reason that 90% of us would never be able to pay our health care bills without the help of our employers and the government. What a racket!

For breakfast we have coffee and Danish, neither of which is providing any nourishment for our bodies. Then we eat a stack of pancakes with maple syrup. Nothing healthy there, either.

Then, all day long we drink Coke and Pepsi®, each with about 10 teaspoons of sugar in them. Or much worse, diet Pepsi or Coke with aspartame for sweetener.

The president of Coca-Cola® in 1993 made over $4 million, the president of Pepsi made over $11 million, and the president of Budweiser® made $13 million, all for making products that you can't stop drinking and which are taking years off your life. And not only here in the US. I was reading about a town of 6,000 in Mexico that averages 4,000 cans of Coke a day!

If you look at the ingredients label on packaged foods you'll see that sugar is high on the list of many, if not most. In 1994 we averaged 150 pounds of sugar per capita! That's about 600 calories per day per person! No wonder we're a fat, constipated, sick people.

Yes, I know — I've been eating candy too. Well, we have a Lindt™ factory here in New Hampshire and there's a Lindt store in nearby Keene — and Lindt chocolate is the best in the whole world. Wow, is it good! So I know how hard it is to give up

Continued on page 85

LETTERS
continued from page 7

copper that went onto the cathode. All but the coin electrodes lost about the theoretical amount. but what they lost remained either in the cotton pads or as a crust of insoluble salt on the anode. The loss of weight from the coin anodes was well under theoretical. These tests did not indicate whether any ions would actually pass through the skin. but the evidence looks slight. Even the tiny amount of copper that went through the pad represents an amount equivalent to several years of usage with the five microamps of unbalanced current.

But I had an even simpler circuit in mind. one using a 4047 CMOS multivibrator that has complemented outputs. which automatically provide an exactly balanced output. even though it probably isn't needed. The circuit here shows how this IC is used. The total current will be under three milliamps. way below my estimate of 17 mA for Miller's latest circuit. Timing is done with a single resistor and capacitor. providing 6.9 Hz with the values shown. The base resistors are not critical: I have had success with values from 10 k to 20 k. The 33 k resistors on the transistor collectors may be lowered if you want more current. such as 22 k in Miller's latest circuit. Miller said his original circuit had spikes on the output transitions that burned some people. but neither of mine show any spikes. If you worry about this you can put a small capacitor across the output leads. The 0.1 pF shown gives well-rounded transitions. If you build this you can use your own circuit building judgment or follow Miller's guidelines for his circuit. I like printed circuit boards, and this one is easy to make. I used a 2- x 3-inch scrap of PCB to give lots of room. I use a fine artist's brush to draw the pattern. using tinted shellac (methylene blue in regular shellac. for example). Be generous with the shellac. After it is well dried I etch it in ferric chloride solution, clean it with alcohol and burnish with Comet™ cleanser. Then drill and wire it. Otherwise you can use prototype boards from Radio Shack™.

Antonio Anzevino WB2KDE. Your December 1997 "Never Say Die" column was as great as ever. I especially liked your short article on Dr. Takahashi's magnet powered motor scooter. It's unfortunate that your article was so short in its description of Dr. Takahashi's motor's principal operating theory. other than "it works." An article on this would be of extreme interest to the technical readers of your magazine. How about a follow-up article on this magnetic motor, including some sources. where one can write to. for further specific information and details.

Magnet motors in 73? Well, why not? So get busy and do some research and tell the rest of us how and why these darned things work. I sure don't understand it, and I've seen the patent. Look up #5.436.518 (1995) and 5.030.867 (1991). Contact Takeo Sawai at Sciex Ltd.. 20 Hocroft Road, London NW2 2BL for more information. I think they may finally be starting production on the scooters. Also, Joe Newman has been demonstrating a similar magnet powered motor for some years. Try him at Route 1, Box 52, Lucedale MS 39452 (601-947-7147) ... Wayne.

Jim Parker ABØEZ. I just finished digging out my 30-foot driveway from three feet of snow. No. I didn't use a snow blower, just good old armstrong. I'd like to see some of you fatty, beer-swilling, cigarette-sucking hams do that at 6500 feet above sea level. After doing a lot of thinking I have an answer for why we let dentists poison us with mercury fillings: why we keep reelecting the same old crooks to Congress: what is our Rocky Mountain ARRL representative doing to increase public awareness of the heroic efforts local hams put in to help people out during the October 1997 blizzard (or is this just another opportunity to increase our ranks lost? After all. we don't want any new hams to increase the QRM on 20 m. do we?); why, after 10-plus years. are the majority of packet nodes still creeping along at 1200 baud: why do we Americans prefer to take a bunch of pills instead of changing our lifestyle habits: why do we blindly take what our doctors say as cast in concrete and not ask questions; why do we, as hams, let the League continue to whittle away at our numbers without doing anything; why do we let the League insist on keeping CW as a rite of passage (or hazing) to get on our HF bands? The answer. Wayne. is very simple: Baa. baa. For the record. I'm an Extra Class ham and a VE. I love CW. but that is my own personal choice. Now that I'm a known troublemaker. I'll probably get flame mail from the good old boys. I'll be happy to answer every one [Jimparker@bewellnet.com].

Adventures in Regulation
continued from page 65

the collector current rarely exceeds 20 mA. However, transistors with the lowest saturation resistance provide the lowest control voltage value. A potentiometer is still used for voltage control. but the value range is 0–5 k for a regulated output voltage range of 5–30 V.

Notes

The following are some cautions to be observed when using three-lead regulators:

(1) The maximum input-to-output voltage for the selected regulator (typically 35 volts) must not be exceeded. When used in a variable voltage application, the largest differential between the input and the lowest controlled output creates the greatest heat dissipation at a given output current value. Therefore, it is desirable to operate the supply voltage at the lowest possible value in order to achieve a low device dissipation, but high enough to provide the desired regulator function. The regulator will require a minimum headroom differential value of about five volts to keep it regulating.

(2) The output current of the selected regulator should not be exceeded, even though some regulator types will have an internal current-limiting feature for protection.

(3) A suitable heat sink must be provided to dissipate device heat. The maximum amount of heat to be dissipated can be calculated by multiplying the maximum voltage differential (input voltage minus the lowest output voltage) by the maximum current (typically 1.5 amps). Thermal grease must be used between the device and the heatsink for best heat transfer.

(4) A reverse-biased diode must be placed across the regulator to protect it from a reverse polarity situation. A series pass regulator must be protected from any reverse voltage exceeding one volt.

(5) The typical input and output capacitor filtering, etc., for the regulator must be provided even though not shown in the figures. The figures are intended only to show the methods for controlling the output voltage value.

SPECIAL EVENTS

continued from page 36

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

APR 18

WHEATON, IL In commemoration of the 50th anniversary of the club, Wheaton Community Radio Amateurs will operate W9CCU 0200Z–2000Z, on or near 3.880, 7.280, 14.280, and 21.380. QSL with a 9-inch x 12-inch SASE to *Ron Hensel K9ZZE, 43W275 Hawkeye Dr., Elburn IL 60119 USA.*

WILMINGTON, NC The Azalea Coast ARC will operate AC4RC, 1500Z–2100Z, from the original radio room of the Battleship *USS North Carolina BB 55.* Connect with them on 7.250, 14.250, 21.35 and 28.400. QSL *AC4RC, P.O. Box 4044, Wilmington NC 28406 USA.*

APR 24–25

THOMASVILLE, GA The Thomasville ARC will operate W4UCJ 1700–2300Z April 24th, and 1100–2000 Z April 25th, to commemorate the 77th Annual Rose Festival. Operation will be in the lower portion of the General 80, 40, 20, and 15 meter phone subbands, and the Novice 10 meter phone subband. For a certificate, send your QSL and a 9-inch x 12-inch SASE to *TARC/ Rose Festival Station, P.O. Box 251, Thomasville GA 31799 USA.*

APR 24–26

ALBUQUERQUE, NM Station N4C will be operated Apr. 24th 2200 UTC–Apr. 26th 1700 UTC to commemorate the Four Corners State Boundary that is shared by the states of Arizona, Colorado, New Mexico, and Utah (USA). This event will coincide with the NorCal QRP Club's "QRP-to-the-Field '98," where the theme is "Run to the Borders." Updated info will be posted to *[http:// www.swcp.com/~n5zgt/].* E-mail queries to *[wa5whn@rt66.com]* for further info. Please QSL with a business-size SASE to *N4C, c/o Jay Miller WA5WHN, P.O. Box 6552, Albuquerque NM 87197-6552 USA.*

MAY 2–3

1998 CONNECTICUT QSO PARTY The Connecticut QSO Party, sponsored by the Candlewood ARA, will operate 2000Z May 2nd–2000Z May 3rd, with a rest period 0400–1200Z. Phone, RTTY and CW. CW—40 kHz up from lower band edges; Novices 25 kHz up from low end: phone—1.860, 3.915, 7.280, 14.280, 21.380 and 28.380. VHF—50.150, 144.200, and 146.580. RTTY—normal RTTY bands. All bands (HF, VHF, UHF) except WARC bands count. For rules and info, please contact *CARA, P.O. Box 3441, Danbury CT 06813-3441 USA.* Remember to enclose an SASE. Send entry and SASE for results by June 3rd.

MAY 9–10

OREGON QSO PARTY The Central Oregon DX Club, K7ZZZ, will sponsor the 1998 Oregon QSO Party 0000Z May 9th–2400Z May 10th. Suggested frequencies: CW—1.810, 3.540, 3.735, 7.035, 7.125, 14.035, 21.035, 21.125, 28.035 and 28.125. Phone—1.855, 3.905, 7.280, 14.280, 21.380, 28.580. VHF—50.125, 145.025, and 146.550. No repeater QSOs. Awards logs by June 30th to *Oregon QSO Party, c/o C.O.D.X.C. K7ZZZ, 19821 Ponderosa St., Bend OR 97702 USA.* Please contact this address for rules and enclose an SASE.

NEVER SAY DIE

continued from page 83

sugar. Oh, I weaned myself from sugar in my coffee after reading the Melvin Page book. And sugar on my All-Bran® too. But then there's that 13-ounce bar of Lindt milk chocolate that Sherry gave me for Christmas. Sigh.

Over 40 years ago I read a great book by Dr. Melvin Page, who had researched the damage that sugar was doing to us. I've written about this book many times during my last 40 years or so of editorials, and it's still being quoted by current authors in the field.

If you bother to read anything about how the body processes food and uses it, you'll understand the enormous damage that sugar is doing to you and your family. And that includes jam, jellies, honey and syrups. Most of us are seriously addicted to sugar. If you think I'm exaggerating just try for one week to stop eating anything with sugar in it. Good luck.

There are at least two inexpensive books that you *must* read. Please don't let your usual procrastination stop you on this. Call (800) 243-1438 and order (#5745) *Lick The Sugar Habit*, and (#5880) *Beating The Food Giants.* They're $6 and $10 respectively, plus $3 s/h. That's the number for Radio Bookstore in Seattle. No relation to Radio Bookshop.

Once you find out the part that sugar plays in heart disease, diabetes, and a host of other awful diseases, maybe you'll be able to kick the habit, too.

So watch out for the stuff those Generals are pushing you to eat. Colonels too. The major problem is that it'll damage your body. Are you the captain of your fate or is the media? A good basic rule: If it's advertised on TV, don't eat it!

EMF Damage

A note in *Time* magazine said that women who use an electric blanket at the time of conception or in early pregnancy have a 75% greater chance of having a spontaneous abortion. It seems to me I wrote about this hazard several years ago and got hoots of disbelief from a bunch of readers.

But how come the doctors doing this research haven't figured out that if the alternating current magnetic field from an electric blanket can increase spontaneous abortions so significantly, that this field is also going to affect to some degree any cell growth it impacts? Suppose the screwing

Continued on page 86

HOMING IN

continued from page 79

The processor will send the callsign presently in data memory in slow CW. Set S1-1 to S1-8 for the binary code representing the first character of your callsign, then press the LOAD A LETTER button (S2). Repeat for the remaining characters of the callsign. The unit sends the character in CW when S2 is pressed, for verification. Now set S1-1 through S1-8 to 11111111 (End of Message) and press S2. Set S1-1 though S1-9 for the start delay, fox number and number of foxes, remove jumper JP1 and press S3.

An automatic shutoff is included in the program to stop transmissions after four hours. This feature is used in European hunts to signal the end of a practice session. It also prevents complete discharge of the fox batteries if the box isn't recovered immediately. Shutoff time cannot be programmed in the field. If you anticipate very long hunts, you can change the shutoff timer values in the source code and reprogram your PIC.

Plan some hunts now

Spring is here, so your club should be scheduling its warm weather foxhunting activities. Since announcement of its formation was made in "Homing In" for January, the North American ARDF Organizing Task Force has received inquiries from many hams in the USA and Canada about plans for national and international foxhunting championships. We want to hear about activities in your area, too. To become an ARDF Point of Contact for your locality, please send E-mail or postal mail to me.

QRX

continued from page 9

is this: All electronic devices—and especially ICs—work on smoke.

Yes, that's what I said: Smoke! I have recently discovered that every electronic device manufacturer and all IC makers encapsulate a certain amount of black smoke in every one of their devices. This smoke is what does the work and performs the magic of electron flow inside the device.

Undoubtedly, you have often noticed that a component will quit working when this encapsulated smoke leaks out. I have documented this many times, and it conclusively proves my theory. After all, when a storm comes up, the sky gets black. The lightning starts to flash through the black clouds, which must be smoke. But when the smoke is gone and the sky clears and is no longer black, the lightning stops!

So, the smoke is the answer to electron flow. Proof positive: Have you ever been able to operate an electronic component after the smoke has leaked out? I rest my case ...

Author unknown, but found on the Web by and reprinted in *Static*, newsletter of the North Hills Amateur Radio Club, Pittsburgh PA (September 1997).

When CW Is Seen and Not Heard

It turns out that I was exposed to CW most evenings for about the first 20 years of my life. That didn't really hit me until the other night.

The house I grew up in is located in the Hollywood Hills, and has a beautiful view of the city. The Capitol Records building can be seen from almost any window in the house. It looks like a record player with a tall needle on top. That needle has a blinking red light, just like any other tall structure.

I remember my parents telling me that the blinking light spells out "Hollywood" in Morse code. I do remember watching the light as I was growing up and noticing that the blinking was not regular, but it never occurred to me that one day I might be able to confirm what I had been told.

I took my kids to Los Angeles to visit my family last week, and on the last night of our stay, I found myself gazing out the window during dinner. All of a sudden I remembered what I had been told about the light on the Capitol Records building, and I realized that I could actually test the claim. It took me a minute to get a feel for the dits and dahs, since the sending speed is quite slow (about 1 wpm?!!). Then, I said to my parents, "I think that was a D." Finally, after a pause, I copied H, O, L, L, etc. That blinking light does indeed spell "Hollywood" in CW!

This probably sounds like quite a minor accomplishment, but it struck me that although I had seen that blinking light for much of my life, only now have I been able to "hear" it. It's like the feeling you get when you learn a foreign language, and then you can't remember what it was like to not be able to understand those words. It's the same way with CW. I don't think I'll ever be able to look at the Capitol Records building the same way again.

Now, if my kids would only give me the time to copy something other than a blinking red light spelling "Hollywood" ...

TNX Kelly Fast N3XUJ and *The Ham Arundel News* (Anne Arundel Radio Club), December 1997.

Never Say Die

continued from page 85

up of cell growth in the fetus is such that it isn't enough to bring about a spontaneous abortion? It may not even affect cell growth in areas that will be clearly visible as deformities in the child. But the normal cell development will be affected, so the child is not going to have the full benefit of the DNA plans inherited from the parents. The result may be a sociopath, subtle retardation, some weak organs and a predisposition to some illnesses. It's a crap shoot, with no possible winners, just various magnitudes of loss.

The magnetic field from an electric blanket will act the strongest on fast-growing cells — like those in babies and children, which explains why so many children living or going to school in high-magnetic field environments get leukemia. But it also explains why adults get cancer and tumors in the same fields. The cell division and growth may be slower in adults, but it's going on all the time and plenty of misery can come from cell growth which has been screwed up by an alternating-current magnetic field.

So throw out your electric blankets and bundle up with blankets and a comforter.

We need to learn a lot more about the effects of steady magnetic fields on plant and animal growth, as well as alternating frequency fields of different frequencies. Anyone willing to spend a few minutes setting up an experiment on the kitchen windowsill with seeds in identical dirt, some with the north pole of a magnet under them, others with a south pole, and a control group with no magnet will see the incredible difference this makes in just a few days. It's a little more difficult to set up the experiment with an alternating field below the seeds, but wait'll you see what results when you do! Scrambled genes.

I spent years being toasty under an electric blanket — until I started reading about the damage that EMFs could do. I then got a milligauss meter and checked my electric blanket. Wow! That was the last day I used it.

Well, all unwell and bad for 60 Hz fields, but how about cell phones? Maybe you read recently about the Australian doctor who did a study on this and reported a 50% increase in brain tumors for cell phone users. That's something to think about the next time you put an HT near your head. It also confirms the research published by Dr. Ross Adey K6UI, the leading expert in the field.

The power and radio industries are in denial, of course. Why does that remind me of the tobacco executives swearing to that congressional committee that cigarettes are not harmful. And before that the asbestos industry played the same record. All the studies are flawed, they claimed. Sure.

Pulsing

A letter from Rudi Mangold HB9DU/W6 discussed his use of high-energy pulses to kill viruses and bacteria in water. Anyone know more about that? It might be better than pasteurization for milk, if it doesn't change the taste. Rudi also said that high-energy pulses will disintegrate stones and even a refrigerator in a water tank. The tank is the positive pole and then a thick stainless steel pole is put into the water a little above the object to be disintegrated and a nanosecond negative pulse of energy is used. Rudi says he's using 250,000 volts at 6,000 amperes. Good grief, that's 1,500 megawatts! But in nanosecond pulses for two or three nanoseconds, so the average power needed is relatively small. The resulting powder can then be separated using normal flotation methods. This might be an inexpensive system for separating gold from ore. I hope that Rudi will be able to get an experimental pilot plant built — and invite me to see it.

There are so many potential areas open for inventing and pioneering that the mind boggles. But, I wonder, is there *anything* that will get you out of your rut? My grandfather was an inventor, so perhaps I inherited something from him. His inventions founded what you now know as Citgo™. My father was an aviation pioneer — pilot's license #73, by coincidence.

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

There is evidence that the HF bands are finally "waking up" and solar flux levels have begun their long-expected steady climb. However, operating conditions this month could be erratic — typical of the spring equinox and also the beginning of a new sunspot cycle.

The ionosphere from about April 7th–12th is likely to be very disturbed, accompanied by high signal absorption (A and K indexes high) and poor or non-existent DX on near-polar transmission paths. In contrast, transequatorial paths could be useful during the same period.

Possibly severe weather and other geophysical upsets are likely on the days surrounding the 9th and 10th, but increased activity is likely on the VHF bands at the same time.

10–12 meters

Generally Poor, except for occasional transequatorial propagation with F2 openings on the best days—most likely South and Central America.

15–17 meters

DX to Africa and Latin America on the Good days possible, with short-skip out to about 1,000 miles or so in the US.

20 meters

Your best band for DX openings around the world from dawn to dark, and openings to the Southern Hemisphere after dark in evening hours. You can expect excellent short-skip during the daytime to 2,500 miles or so.

30–40 meters

These bands ought to be open for DX from just before sunset to just after sunrise. Signals from the east should peak until midnight, and after midnight to other areas. Daylight short-skip of about 500 miles will be possible, and nighttime short-skip to 1,500 miles or more will be available.

80 meters

Occasional DX to various areas of the world should be possible between sunset and sunrise when QRN levels permit on Good (G) days (see calendar). Short-skip during darkness to 1,500 miles or more.

APRIL 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G-F	4 F-P
5 P-F	6 F-P	7 P	8 P-VP	9 VP	10 VP-P	11 P
12 P	13 P-F	14 F	15 F-G	16 G	17 G-F	18 F
19 F-P	20 P-F	21 F	22 F-G	23 G	24 G-F	25 F
26 F-G	27 G	28 G	29 G	30 G		

160 meters

This band ought to begin to come alive again during the hours of darkness when QRN permits. Try the days marked G on the calendar for best results. DX toward the east until midnight, and to other areas afterwards until dawn. Short-skip to 1,500 miles will prevail when the band is quiet.

Note about chart: The indicated band is only a guide. Always check the next higher or lower band. Where 10 meters is shown, listen on 12; where 15 meters is indicated, listen on 12 and 17; and so forth.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	14	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	14	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	14	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	14	14	14	14	14	14	14
WEST COAST	14	14	14	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	7	14	14	14
ARGENTINA	21	14	14	7	7	7	7	14	14	21	21	21
AUSTRALIA	21	14	7	7	7	7	7	7	7	7	14	14
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	14	14	14	14	14
HAWAII	21	14	14	7	7	7	7	7	14	14	14	21
INDIA	14	14	7	7	7	7	7	7	14	14	14	14
JAPAN	14	14	14	7	7	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	7	14	14	14	14
PHILIPPINES	14	14	14	7	7	7	7	14	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	14	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	14	14	14	14	14	14

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	14	14	14	14
ARGENTINA	21	14	14	14	7	7	7	14	21	21	21	21
AUSTRALIA	21	14	14	14	7	7	7	7	7	7	14	21
CANAL ZONE	21	14	7	7	7	7	7	14	14	14	21	21
ENGLAND	14	7	7	7	7	7	7	7	14	14	14	14
HAWAII	21	14	14	14	7	7	7	7	14	14	21	21
INDIA	14	14	14	7	7	7	7	7	14	14	14	14
JAPAN	14	14	14	14	14	7	7	7	14	14	14	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	14	14	14	7	7	14	14	14	14	14
PUERTO RICO	14	14	7	7	7	7	7	14	14	14	14	14
RUSSIA (C.I.S.)	7	7	7	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	7	7	7	7	7	14	14	14	14	14
EAST COAST	14	14	14	7	7	7	7	14	14	14	14	14

UPDATES

Just a little stutter ...

In March's ID-8 review, the ZIP code for Communications Specialists has an extra "6" in the middle. The correct mailing address should read:

Communications Specialists, Inc.
426 West Taft Avenue
Orange CA 92865-4296.

Including Ham Radio Fun!

73® Amateur Radio Today

MAY 1998
ISSUE #452
USA $3.95
CANADA $4.95

International Edition

2 El. Fox Hunter

El Cheapo 20m Unbeam

Rx Sensitivity Booster

Weather Rx Interface

What's this DDS Stuff?

Review:

GMSK 57.6k Packet Modem

0 74851 08725 1

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

MAY 1998
ISSUE #452

73® Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

FEATURES

DEPARTMENTS

REVIEW

HAM RADIO FUN SECTION

On the cover: Captured on film by Joe Moell KØOV, this ammo-box fox first appeared in the pages of our March issue. You can find foxhunting fun every month in Joe's "Homing In" column.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine No part of this publication may be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

New Licenses

In looking at the December 1997 FCC figures for new licenses issued as compared with December 1996, I see that the number of new no-code Tech licenses dropped 42% and the number of new General licenses dropped 41%. Just in one year! Does anyone have any ideas on why the interest in amateur radio seems to be dropping like a lead balloon?

Let me know when you think it's about time to start advertising and promoting our hobby. Better yet, let the League and your director know. I'm in a good position to wring my hands. They're in a good position to mount a PR blitz.

When was the last time you saw amateur radio portrayed favorably on TV or in the movies? If there have been any articles in any of the major magazines about how much fun the hobby is, how it makes it so one need never be lonely again, and how there are all sorts of adventures possible, you haven't sent me a clipping. Isn't there something in the ARRL charter about helping to preserve the hobby?

The League is supposed to do what the members want. If you are a member, you are voting with your membership payment, your buying of League books, and your patronizing (spending money with) the *QST* advertisers. You really *do* have a lot of clout, if you want to use it.

Morse Requiem

Darn, I've forgotten the name of the chap who really invented the International Continental Code. I'd put it down to getting old except that I've always had a lousy memory, and it's been a bunch of years since I've written about the subject. No, it wasn't Morse. Old Sam, who's gotten the credit, devised the code used by telegraphers with those sounding units. I had one around here, but some past editor stole it. Morse's code went clickety-clack, not dah-di-di-dah.

Well, no matter whose code the League is trying to preserve as a way to keep our numbers limited and make sure we have as little political clout as possible, the dratted stuff is slowly dying. Indeed the plug has been pulled by one service after another. In the 1980s, the International Marine Organization phased it out, replacing it with land- and satellite-based systems. All cargo ships of more than 300 tons will be required to comply with the new regulations by next year.

The US abandoned monitoring 500 kHz, the distress channel, five years ago. Canada dropped this service on the West Coast last year. On the East Coast, a few Coast Guard stations will monitor the channel until next year, just in case. French listening stations went QRT two years ago. Britain has also ended monitoring 500 kHz.

Most craft these days have an Emergency Position Indicating Radiobeacon which they can throw into the water and which will transmit their location via satellite. These signals are then relayed to other nearby ships. There are also search-and-rescue transponders which will show on ship's radar, helping find ships in time of distress.

Some sailors are using cell phones.

These days about the only place you'll hear the code being used is on a small segment of a few ham bands.

A recent survey of new hams showed that over 99% of them said they had no plans for using the code in the future. It is estimated that there are perhaps a couple thousand US old-timers who really enjoy CW and are using it on a regular basis for making ham contacts.

The League Slump

I didn't realize how much the League's position on maintaining the CW barrier was hurting their membership until I looked over their figures for 1996 vs. 1995 (it's still too soon for the 1997 figures). I was amazed to see that the membership dropped by almost 3% in just one year! And this while the number of hams grew by over 12,000. Only 2.9% of the Novices were League members. One would expect newcomers to the hobby would be almost 100% joining the League, anxious to learn more about hamming and deciding on the equipment they'll want to buy. One would be in total error.

A pathetic 15% of the Techs have bothered to join the League. And only 20% of the Generals. Obviously the League and *QST* are seen as either irrelevant or the enemy by almost 80% of licensed amateurs. Yet this is the group that says it is representing all of us.

This monumental failure on the part of the League to be relevant to today's hams tells us that the ARRL Board of Directors has failed in their responsibility to their constituents and the staff of *QST*. Someone needs to get in there and shake some sense into the directors and get them to take their responsibility seriously. Or perhaps sue them for malfeasance. And *QST*, which still remains a 1930s kind of magazine, needs some fresh blood, too. Other than the larger size, the magazine looks and feels about the same as it did 60 years ago, when I first joined the League in 1938. It has all the personality of an automatic dishwasher, but is not as up-to-date.

The same old contests, year after year, decade after decade, eon after eon. The same page after page of "membership news," which is of little interest to anyone. I've never bothered to read this section. It's a sterile, boring, self-serving magazine.

A note from Guy Matzinger W1GUY points out, complete with documentation, that it was the ARRL which, in 1936, got the FCC to increase the code speed from 10 wpm to 13 wpm, with the claimed intent being to limit the number of hams coming into the hobby, there being about 46,000 at that time. The bands were getting too crowded. The FCC went along with it because the military wanted as skilled a pool of trained CW operators as possible, in case of war.

Well, that made sense 60 years ago. Today, with more modern communications techniques making it so we have room for several million hams on our bands, and with the military having no more interest in us, it is numbers and numbers only that will keep the hobby afloat.

The recent articles on the FCC auctions make it very clear that our ham bands are in the queue for auctioning. With a dwindling number of hams using our HF bands, and with our average age creeping towards the Social Security check crowd, and with almost zero cultural diversity, either

the ARRL will have to come to its collective senses and wake up, or we're history.

Ham Fundamentalists

Good grief, it was 40 years ago at the ARRL Convention in Washington DC in 1958 that I heard a chap give a talk on why we should get rid of the Morse Code barrier to getting a ham ticket. I remember the convention because at the time my old submarine, the *Drum* SS-228, was tied up at the Washington Navy Yard and the convention had made visits to the boat available via buses. I spent a good part of the day showing hams through the *Drum*, explaining what all the valves were for, and what we did in all of the compartments.

Forty years ago the code barrier to a ham ticket no longer made any sense, so I started writing about it in my editorials. In 40 years no one has yet come up with a new excuse for maintaining this painful hazing barrier to entering hamdom.

Long ago I pointed out that the Moose Cud is a religious matter and thus not one open to a reasoned discussion. It's a matter of unfounded belief, with many of the true believers ready to kill (the hobby) to protect their belief. Well, we've seen the actions of religious fundamentalists who have killed nearly 100,000 in Algeria recently, so this should be no surprise. And then there's the fanatics in Iran, Afghanistan, and Jerusalem.

The fanatics won again at Geneva with the latest radio conference where any action on eliminating the Mace Clod from the ITU rules was postponed for another four years.

On the one hand, I rejoice — because this means that I'll be able to sell my Mince Coat course for another four years, making a fortune on the suffering of others. I have the fastest, easiest course there is for learning the fool Mercy Crud. If more potential hams knew how easy it is to ace the test using my system, we might not have the top-heavy Tech Class licensee numbers we have today. Almost anyone can pass the 13-per test in a weekend if they get my tape and follow my instructions. For that matter, 20 wpm doesn't take a lot longer.

An eon or so ago, right after the ARRL whipped their brainwashed multitudes to a frenzy (shades of the ayatollahs), protesting to the FCC over the proposed no-code ticket, I took them at their word. They claimed that the ability to use Moss Code was of critical importance for emergencies. So I said, okay, if that's what you honestly believe, then let's make sure that you don't lose that valuable skill — by having a code test at every ticket *renewal* time. Wow, the screams of anguish that one roused! They didn't mean that *they* should be able to copy the code any more, only that *newcomers* should.

I'm still seeing letters from hams convinced that the Mars Cold must be retained. Viva progress.

With the advent of thousands of tons of war-surplus gear, plus endless cheap parts from manufacturing overruns, ham radio got one heck of a jump start 50 years ago. That's when stabilized VHF gear became possible, and VFOs appeared for the low bands. We were on an inventing and pioneering jag, with NBFM and RTTY in the late '40s and SSB in the late '50s, followed by SSTV, moonbounce, solid state and then ICs. Then, 30 years ago, when the greatest catastrophe in the history of the hobby hit, our pioneering and progress virtually stopped.

At the time I got started in ham radio the code test no longer made much sense, and that was 60 years ago.

The fact that all amateur matters before the WRC in Geneva were tabled for the next WRC in four years shows that as far as most of the administrations around the world are concerned, we're not worth taking the time to discuss. For most countries our ham bands aren't yet badly needed.

If you read the reports on the 1997 conference you'll note that commercial interests have tight control of the ITU these days, so as soon as there is a commercial need for our ham bands, they'll come up for a "discussion" and subsequent loss at the ITU.

The ARRL board response to that? It's doing its best to discourage new hams from being interested in the hobby.

League Bashing? Me?

Actually, I'm more bashing my fellow League members. I should be getting my 60th year membership certificate and pin this year — a member since 1938, so I feel a vested interest in the League's responsibility to preserve and protect amateur radio.

My first beef is that the League has not stayed relevant to us hams. I see this in *QST* and in the total lack of communications from my Division Director, whoever he is, to keep me informed on what's going on in the hobby, what the League is doing to deal with current and known future problems, and to solicit my input (and that from all other ARRL members in our division). I see a serious problem in the membership totals, with only 22% of the General Class licensees being members, an almost invisible 16% of the Techs, and (wow!) 3% of the Novices (there are over 90,000 Novices).

With the major part of the newer licensees not getting *QST*, I can see why the ham industry is hurting so badly. Virtually all of the companies are advertising almost totally in *QST*, and the newer hams, the people who are buying their first stations, obviously aren't seeing the ads.

Continued on page 31

Number 6 on your Feedback card

Letters

From the Ham Shack

William H. Alliston W3ICB. Every 18-wheeler that leaves the factory with a load of cigarettes should carry along a couple of coffins for the convenience of the customers! When I tell that to my smoking friends, their response is usually something like, "No way (cough!), it can't (hack, cough!) be that bad. You're out (cough, cough!) of your mind." Well, maybe I am, but if you don't believe it, do the math:

1. A trailer truck can carry about a half-million packs of cigarettes.

2. With about 120 million smokers in the US, at two packs a day per smoker, it would take around 175,000 truckloads to meet their demand each year.

3. The American Cancer Society tells us that about 350,000 smokers die prematurely each year in this country from the effects of smoking.

4. Divide that 350,000 by 175,000 truckloads and you get two per truckload. To my way of thinking, that makes cigarettes one of the most dangerous cargoes transported in the US. It should beat out gasoline, nuclear waste, explosives and just about any other shipment you can think of.

Jeez, another troublemaker ... Wayne.

Rick Aiello, NY. During the 1980s I worked for the Eastman Kodak Co., Copier Division. I was determined to shine through hard work. I was not only productive, but very active in the company suggestion program. I submitted many suggestions that made a few extra bucks for me and saved Kodak thousands. I had so many reviewed and adopted that my supervisors were embarrassed by their overlooking these ideas and concepts during the R&D phase of the part or assembly. One viable suggestion was turned down "because it was already being done that way." What my supervisor did was when the suggestion package went across his desk, he went into the planning office and pulled the procedures file for the part. He then adopted my proposed change and tossed out the old plan and progress sheet. He was inept at his job and was threatened, so I set him up. My next suggestion was submitted after I made copies of all the pertinent process sheets. He did the same thing again and this time I had the copies to prove he'd altered the existing paperwork. After an investigation they dumped him, but on the next downsizing I got the door. So I went to work for a small company, learned the business, and two years later I was in business for myself. From making $600 a week I went to $5,000 a week. It was the best time of my life! Last year I sold my business and moved to the country.

As I've written, if you're working for a big company, you're a sucker. If you work for someone else for more than a couple of years, you're a sucker and deserve to be a proud member of the gradually disappearing middle class. Also, if you eat any food product advertised on TV, you're a sucker and you deserve every illness that results ... Wayne.

Guy A. Matzinger W1GUY. The latest chapter in the Morse Code soap opera has drawn to a predictable close, when the ITU World Radio Conference opted not to address Article S25 and the International Morse Code Treaty obligation. Their excuse: "Due to a crowded agenda, consideration of S25 will be put off until WRC2001 (or later?)." Reminds me of the movie *Conspiracy Theory*, in which Mel Gibson, when asked whether his various theories could be proven, said: "No. If they could be, something must have gone wrong." That puts conspiracies safely in the realm of imagination and conjecture. However, when Communist revolutionaries seized power in Russia, they emerged from the concealment of conspiracy into open dictatorship. Lenin was one of the most successful conspirators of all time. I am also reminded that some allegedly "democratic" amateur radio organizations are pretty good at aristocracy: the system, as Aristotle defined it, in which the virtuous elite decide things for the common individual. There's no denying that these organizations take to the pursuit and maintenance of power as naturally as sharks to open wounds. For months they have led a campaign against removing Morse Code requirements from the International Treaty obligation. Why? Why now, when contrary to some claims, today there is a good deal of evidence from around the world that suggests that either eliminating or limiting code tests to not more than 5 wpm does not cause congestion, revitalizes the economics of the hobby, induces the young to participate and expands membership in both local and national organizations, but maybe that is not what the spectrum keepers want.

It appears that these authoritarian conspirators, in combination with others, consorted to fight the specter of competition and skillfully waged a propaganda campaign that managed to bamboozle gullible administrations into believing that no country should be free to decide their own code testing course of action. What is the compulsion that really motivates these fanatics? Are they paladins of progress or frauds who would make international names for themselves as opponents of reform? The majority opinion means nothing to these guys, and whenever given the chance, they connive to restrain and limit participation in amateur radio.

Thousands of amateurs believe they are targeted by a licensing system determined to prevent them from participating in all aspects of the hobby. This perception of unquestioned reality, and the effect of this divisive policy, have overwhelmed the amateur community. Refusing to address or even to rethink code testing requirements will only tear this hobby apart—and do nothing to preserve the future of amateur radio.

Conspiracy? Maybe, but I suspect that amateur radio problems were tabled until the next WRC more because none of the participating administrations wanted to waste time on such small peanuts ... Wayne.

Rick Mudd KC7WGS. Where in the world did you dig up that whiner, Dr. Harold I. Goodman? When I read his "Letter from Down East" in the February issue I have to say that I was disappointed that you'd waste space on someone who obviously needs to find another hobby, or find a good anger management counselor. He obviously has time on his hands if all he can do is drift through the bands and find things to whimper about. Hey Doc! Here're some suggestions for you: (1) Buy a QRP rig and give it a try. One thing you don't seem to know is that it is usually not perfect operating with a rig that has two knobs on the front of it and usually a less-than-optimal antenna system. We QRPers appreciate you sticking with us, but just because you are putting out 1,000 watts, don't assume we're having a great time of it. (2) If you don't like the code you're hearing maybe you should help the local club provide lessons for new operators. I don't know about your area, but here in my neck of the

Continued on page 79

QRX . . .

Speak Up!

Young hams interested in speaking at the 1998 Dayton hamvention® Youth Forum are enthusiastically invited to contact:

Carole Perry WB2MGP
P.O. Box 131646
Staten Island NY 10313-0006.

Have fun, network, and gain valuable public speaking experience this spring in Dayton!

Dayton Scholarships

The Dayton Amateur Radio Association is accepting applications for its annual scholarship program. Applicants must be amateur radio operators and graduating high school seniors. Eight scholarships of up to $2000 each will be awarded. To request an application, send an SASE to: DARA Scholarships, 45 Cinnamon Ct., Springboro OH 45066-1000. The application deadline is June 1.

Seen in *Harmonics,* newsletter of the South Jersey Radio Association, January 1998.

1998 Scholarships

The Foundation for Amateur Radio, Inc., a nonprofit organization with headquarters in Washington DC, plans to administer 66 scholarships for the academic year 1998–1999 to assist radio amateurs. The Foundation, composed of over seventy-five local area amateur radio clubs, fully funds nine of these scholarships with the income from grants and its annual Hamfest. The remaining 57 are administered by the foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college, or technical school. The awards range from $500 to $2500, with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs are encouraged to announce these opportunities at their meetings, in their club newsletters, on their nets and on their Web pages.

Additional information and an application form may be requested by letter or QSL card, postmarked prior to April 30, 1998, from:

FAR Scholarships
6903 Rhode Island Ave.
College Park MD 20740.

English Volunteers Win SETI League's Bruno Award

The SETI League, Inc., leaders in the privatized Search for Extra-Terrestrial Intelligence, has awarded its highest honor to two radio amateurs from England. Ken Chattenton G4KIR and Trevor Unsworth GØECP, who were the grass-roots group's first two volunteer Regional Coordinators, received the coveted Giordano Bruno Memorial Award for their contributions to amateur radio astronomy.

Three years ago at a conference in Scotland, SETI League executive director Dr. H. Paul Schuch was approached by Chattenton and Unsworth, who wanted to know how they could help build up SETI League activity in their native England. The SETI League was then a small US-based group made up primarily of amateur radio enthusiasts. It was clear that the organization could not contemplate mounting a scientifically significant SETI effort without extensive international cooperation. Ken and Trevor noted that The SETI League had neither the staff nor the resources to coordinate such a global search unaided. They then volunteered their considerable talents and energies to coordinating SETI League activity throughout the UK. Their success can be measured in part by the large number of radio, television, newspaper and magazine interviews they have granted during the past three years. But a better measure is the phenomenal growth in amateur SETI participation throughout the UK since Ken and Trevor stepped forward. Britain's SETI League contingent is now second only to that in the United States.

The English model for local involvement served as the basis for the current SETI League Volunteer Field Organization. Ken and Trevor were the first of a network which has now grown to about 40 regional coordinators on six continents, supporting an expanding membership base. The SETI League owes its current international profile in no small part to the vision and energies of these two dedicated volunteers.

SETI scientists seek to determine through microwave measurements whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have been attempting to privatize the research. Experimenters interested in participating in the search for intelligent alien life, or citizens wishing to help support the search, should visit SETI on the Web at [http://www.setileague.org/], send E-mail to [join@setileague.org], FAX them at (210) 641-1771, or contact The SETI League, Inc., membership hotline at (800) TAU-SETI. Be sure to provide a postal address to which further information can be mailed. The SETI League, Inc., is a membership-supported, nonprofit [501(c)(3)], educational and scientific corporation dedicated to the electromagnetic Search for Extra-Terrestrial Intelligence.

From a press release of The SETI League, Inc., March 21, 1998.

Are You Sure?

Some computer terms everyone should know—

Amiga: A Merely Insignificant Game Addiction
Apple: Arrogance Produces Profit-Losing Entity
CD-ROM: Consumer Device—Rendered Obsolete in Months
COBOL: Completely Obsolete Business-Oriented Language
DEC: Do Expect Cuts
DOS: Defective Operating System
GIRO: Garbage In, Rubbish Out
IBM: I Blame Microsoft
ISDN: It Still Does Nothing?
LISP: Lots of Infuriating and Silly Parentheses
Macintosh: Most Applications Crash; If Not, the Operating System Hangs
Microsoft: Most Intelligent Customers Realize Our Software Only Fools Teenagers
MIPS: Meaningless Indication of Processor Speed
OS/2: Obsolete Soon, Too
PCMCIA: People Can't Memorize Computer Industry Acronyms
Pentium: Produces Erroneous Numbers Through Incorrect Understanding of Mathematics
SCSI: System Can't See It
Windows: Will Install Needless Data On Whole System
WWW: World Wide Wait

A tip of the *73* floppy to KB6CMO for this piece which originally appeared in *The BPARC Communicator* (August 1997) and was reprinted in the *ARNS Bulletin* (November 1997).

Got Us Covered?

Here's our periodic reminder to all of you out there unafraid of a little fame and fortune: You, too, can take a cover shot for *73!* And get paid for it. And have your work seen and acknowledged in tens of thousands of ham shacks and dens and living rooms all over the world. And it's easy!

Yeah, yeah, you say, but I'm not a pro. So what? The vast majority of cover shots for *73* over

Continued on page 48

An RF Sensing Alarm

Save your power amplifier stages ... and your reputation!

Bertrand Zauhar VE2ZAZ
4176 Sylvio St.
Laval QC H7R 5V8
Canada

Have you ever walked into your shack and found out that one of your transceivers was on the air? Surprise! That has happened to me twice in the last couple of years. Once, it was the packet TNC that had crashed, leaving the two meter transceiver on the air for I don't know how long. That obviously blocked the entire packet BBS traffic. Whoops! The second time, my 70 cm satellite uplink transceiver and amplifier had been shooting 100 watts of RF at the stars for 30 minutes without my consent, thanks to one of the gizmos I had built to control the rig. Try to guess how hot the linear was! I decided that I'd had enough. Another occurrence and I would jeopardize my reputation forever.

I had to build a device that would alert me when it detected a continuous RF transmission lasting more than five minutes (a safe margin since I usually do not read the newspaper on the air!). The device would have to be broadband (HF/VHF/UHF), be sensitive enough to detect a five-watt transmission from inside the shack using a telescopic antenna, and produce a sound loud enough to alert me anywhere in the house. It would also have to be self-contained, without any hookups to my radios. After a bit of reading and thinking, I came up with a solution that meets all the initial objectives. Here it is in detail.

Circuit description

The circuit shown in **Fig. 1** may look scary for some of you, but it isn't. It can be broken down into four stages. Let's look at them one at a time.

The first stage acts as an RF sensor circuit. It is made of U1C, one of the four operational amplifiers of an LM324 chip, and its associated input circuitry. U1C is used as a voltage comparator. Note that the two U1C inputs (plus and minus) have similar DC circuits connected to them. The plus input has R7, R8 and D3, and the minus input has R6, R10 and D5. In these two circuits, D3 and D4 are partly biased (about 200 mV of forward voltage) to better exploit the variation of voltage versus current that the diode produces. This translates into increased RF sensitivity.

In an idle condition (no RF detected), potentiometer R10 is set to make the voltage at the minus input of U1C slightly lower than that at its plus input. This keeps the output of comparator U1C saturated to the "high" state (near supply V+). A strong RF signal present at the antenna terminal J1 reaches D3, a Schottky diode, through C3, a coupling capacitor. The diode rectifies this signal and generates a drop of voltage at D3 anode. This makes the voltage at the plus input of U1C fall below the one set at the minus input. As a result, the output of comparator U1C flips down to the "low" state (near ground). In this state, the circuit is in RF detection mode and timer U1B is activated. Note that as soon as the RF signal disappears, the comparator immediately returns to its high state, resetting the entire alarm circuit. Ferrite bead FB1 and resistor R8 are used to block the RF from reaching comparator U1C. Additional RF decoupling is provided by capacitors C2 and C5.

The second stage acts as a timer. It is made of U1B, D4, C4 and R9. U1B is again used as a voltage comparator. When no RF is detected, capacitor C4 is kept charged by the "high" state of U1C. When RF is detected by the first stage, capacitor C4 is left "floating" and starts to slowly discharge through R9. When C4 is sufficiently discharged,

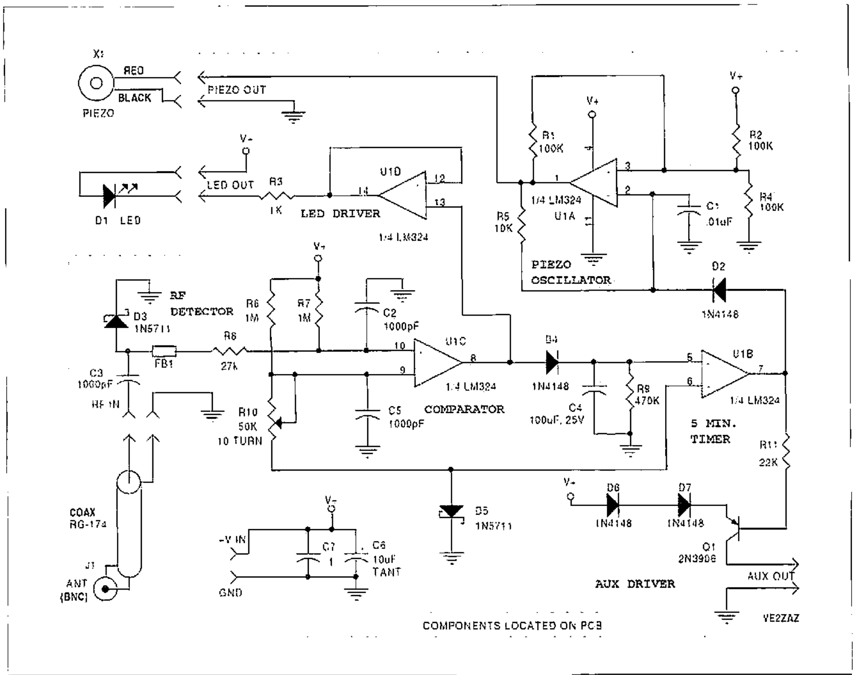


Fig. 1. Circuit diagram for the RF Sensing Alarm.

after approximately five minutes, the voltage at the plus input of U1B falls below the one at the minus input which is set by D5 (about 200 mVDC). As a result, the output of comparator U1C flips down to the "low" state (near ground). In this state, the alarm is tripped. The timer stage drives piezo oscillator U1A and PNP transistor Q1. The latter is added to drive an external device with a voltage close to V+ when the alarm is tripped. The two diodes in series with the emitter provide a drop of voltage so that the base-emitter junction of Q1 is not biased when U1B output is in "high" state. The 2N3906 or equivalent transistor will safely supply a current of up to 50 mA.

The third stage is an astable multivibrator (square wave oscillator) and is made of U1A and surrounding components. It drives the piezo transducer to produce a loud high-pitched sound. The oscillator circuit will operate only when the output of U1B presents a "low" state. Diode D2 serves as an isolating device between the two stages when U1B is in "low" state. The oscillator's frequency is set by capacitor C1 and resistor R5. The values chosen make the circuit oscillate at approximately 2600 Hz, a frequency that causes the piezo to generate the loudest sound.

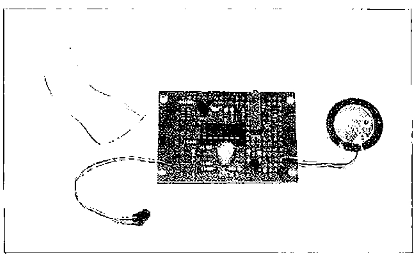


Photo A. The prototype, assembled on a universal printed circuit board.

The last stage is a simple buffer U1D that sinks current to turn on LED D1 whenever an RF signal is sensed by U1C. R3 limits the current to a safe level for the buffer, less than 20 mA.

The balanced input configuration of comparator U1C allows the supply voltage V+ to vary over a wide range and the entire circuit will still work. I designed the circuit for a 13.8 volts supply, but I verified that the circuit works down to approximately 10 volts without recalibrating it, and down to approximately five volts if recalibrated. The high end of the range is more delicate to set since devices such as the LED, the piezo transducer and polarized capacitors may be overstressed if component value changes are not made. Consequently, I would not recommend going beyond 20 volts.

Circuit assembly

This project is relatively inexpensive to assemble. If all the components are purchased, it should cost less than $25 to build it. Obviously, your junk box's size will dictate the cost. I reused components taken from old PCBs and built the project for less than five dollars, including PCB and box.

As shown in **Photo B**, I elected to design a PCB for the project. It is a rather compact design. The intent here is to make the PCB fit in a common Hammond 1591A plastic box. Note that the circuit can be assembled using other techniques: universal PCB, veroboard, dead-bug, wire-wrap and even a combination of these techniques. The layout is not critical except for the RF portion of the circuit: Components D3, C3, FB1 and R8 should be mounted as close as possible to each other, using very short leads. This will guarantee proper operation up into the UHF spectrum. Also, decoupling capacitors C2 and C5 should be mounted as close as possible to pins 9 and 10 of U1C.

An IC socket for U1 is desirable since the LM324 is rather sensitive to pin shorting compared to other operational amplifiers I've used in the past. With a socket, replacing it is a snap.

Ferrite bead FB1 is inserted over a short piece of solid wire and the wire is soldered to the PCB pads. Potentiometer R10 is located on the PCB edge so that its adjustment screw can be accessed through a small hole drilled on one of the faces of the box. I've chosen not to put connectors for external connections to the LED, the piezo transducer, supply line and the auxiliary output. Solder small gauge (#26 or smaller) wires directly to the PCB pads and connect the other ends to the external devices.

For antenna connection, I recommend using a female panel-mount BNC connector. It is small, reliable and will accept most right-angled telescopic antennas when mounted horizontally. Other RF connectors can be used if desired. Since the input impedance of the circuit is quite high, maintaining a constant impedance through the connectors is not an issue. In general, though, it is good practice to

avoid using UHF connectors (PL-259/SO-239) when working above 200 MHz, since they are not of constant impedance type. For coaxial cable, a short piece of RG-174 type or equivalent is preferred to limit overstressing of the PCB pads. This type of coax is much easier to route in a small box anyway. Solder the bare ends directly to the pads.

Someone may decide that five minutes of margin before alerting is too short. C4 and R9 make up the RC circuit that determines the duration. The discharge rate can be varied by changing the value of C4 and/or R9. **Fig. 2** shows a plot of resistor R9 as a function of time for different supply voltages V+. This graph gives a ballpark idea of the resistor value to pick. I computed this graph using a tantalum capacitor for C4. I verified that, in general, tantalum capacitors match closer to the theoretical exponential discharge curve than do electrolytic capacitors. If an electrolytic capacitor is used instead, the user can expect to get about 10 % longer duration than what is indicated on the graph. Electrolytic capacitors are far from being perfect devices (farther than tantalum) and their unwanted characteristics tend to lengthen the discharge duration. Also note that tolerances on the capacitor values will affect the duration as well.

Some comments

Piezo transducers have a resonance frequency that, when submitted to, produces the loudest sound. The piezo I used came out of my junk box. I found that a 10 k resistor for R5 produced the loudest, most unpleasant sound. Using a different piezo element may require a different value of resistance. I suggest temporarily connecting a 50 kΩ potentiometer to find your piezo's "sweet spot." You can then measure the required resistance with an ohmmeter directly on the potentiometer and substitute it with the closest resistor value at the end.

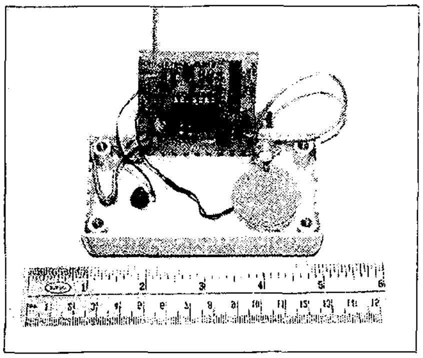


Photo B. The fully wired unit, before closing the cover.

You may have noticed that some piezo transducers have three wires and some have two. Only two wires are used here. The third wire is a feedback signal. If the piezo you are using has three wires, the black wire goes to ground, the red goes to the oscillator and the blue (or other color) is not connected.

Make sure you use an "external drive" type of piezo transducer. Some piezos come with built-in oscillator circuits and will only function if they are connected to the auxiliary output provided by Q1.

Finally, if means of alerting other than piezo are preferred, you can use the auxiliary output to drive an external device. In this case you don't have to install components R1, R2, R4, R5, C1 and D2. Put jumper leads at the place of C1 and R4 to ground the unused LM324 inputs.

Continued on page 14

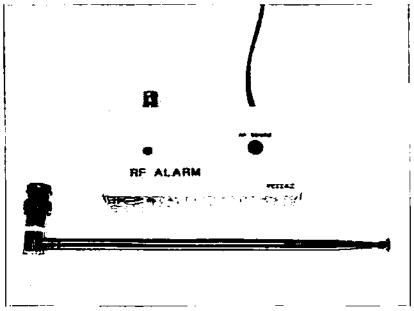


Photo C. The completed project and the telescopic antenna.

Calibrating and testing

When everything is assembled and visually inspected, it is time to apply DC supply to the circuit. When doing so, if the piezo sounds right away, adjust R10 until it stops. If you can monitor the supply current to the design using an ammeter, it should be less than 10 mA. Next do the touching test. There should not be any hot components.

Diodes D3 and D5 must be at the same temperature before calibration is performed. This is critical since temperature offsets can create millivolts of difference and unbalance the circuit. Do not touch the PCB for a few minutes before going any further. To calibrate the unit you will need a digital voltmeter of 10 MΩ or higher input impedance that can read down to the millivolt. First connect the voltmeter between U1C pin 10 and ground. Measure the voltage and make a note of it. Then move the voltmeter's red probe to U1C pin 9. Adjust potentiometer R10 to bring the voltage at pin 9 higher than the voltage previously measured at pin 10. The LED should turn on. Backing off on R10 to bring the voltage below the one at pin 10 should turn off the LED. This verifies that the comparator stage is working properly. Now, adjust potentiometer R10 so that the voltmeter reading on pin 9 is three to five millivolts lower than the value noted from pin 10. This completes calibration.

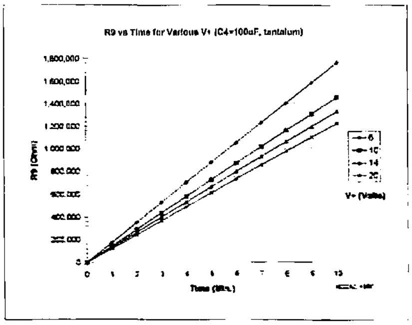


Fig. 2. R9 vs. time for various V+ (C4=100 µF, tantalum).

At this point you are ready to verify the circuit using RF. Attach an antenna to J1. Transmit a constant amplitude signal (AM, FM, modulated SSB) from any of your radios with at least five watts of output power (using another antenna, of course!) and verify that the LED comes on when RF is present. Moving the antenna around in the shack, for example close to a window, may give better results. To verify the alarm circuit, you must maintain RF presence for at least five minutes before you can hear the sound. Make sure the frequency chosen will not interfere with ongoing QSOs, and identify yourself often. When the alarm sounds, stop transmitting and verify that the alarm stops and that the LED turns off. Try detecting RF at other frequencies to verify sensitivity flatness.

Performance

Using a calibrated signal generator, I verified that the alarm's sensitivity is about seven millivolts RMS of RF and is quite flat from 1 MHz to 550 MHz. Sensitivity depends on how close the two voltages at the inputs of comparator U1C are. The circuit is stable as long as the entire design is at the same temperature. This is the case when all the electronics are enclosed in a box. I've used the alarm for a few months now and haven't had to recalibrate it. Since the RF sensing circuit is not tuned, selectivity is dictated by the type of antenna used. I found that about two feet of antenna is enough for proper operation at all frequencies, HF, VHF, UHF. I put the alarm box on top of my radio console and I use a telescopic antenna. Note also that my shack is located in a basement. A bit of experimenting here with antenna type, position and length may be required. I've also verified that I can hear the alarm sounding wherever I am located in the house. This sound is equivalent to a smoke detector, so you shouldn't have any problems hearing it.

I have not been alerted by my new alarm yet, but it gives me a peace of mind that I never had before. Knowing that it's there makes all the difference!

Parts List

C1	.01 µF ceramic
C2, C3, C5	1000 pF ceramic
C4	100 µF, 25 V tantalum or electrolytic
C6	10 µF, 25 V tantalum or electrolytic
C7	.1 µF ceramic
D1	LED, any color
D2, D4, D6, D7	1N4148 or equivalent
D3, D5	1N5711 Schottky
FB1	Ferrite bead
J1	BNC, female panel mount
Q1	2N3906, PNP or equivalent
R1, R2, R4	100 k, 1/4 W 5%
R3	1 k, 1/4 W 5%
R5	10 k, 1/4 W 5%
R6, R7	1 M, 1/4 W 5%
R8	27 k, 1/4 W 5%
R9	470 k, 1/4 W 5%
R10	50 k, 10-turn pot (Bourns 3006 type)
R11	22 k, 1/4 W 5%
U1	LM324 quad op amp
X1	Piezo, MuRata PKM-11 or Radio Shack #273-73 or equivalent
Socket	14-pin DIP
Coax	RG-174 or equivalent
Box	Hammond 1591A suggested
Right-angle BNC telescopic antenna	

Table 1. Parts list.

A Pleasant Visit to the DDS

Direct Digital Synthesis is the latest technology in signal generation.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

There has been quite an evolution over the years in signal generation and frequency control. Signal generation began by using a self-excited oscillator, the stability of which left a lot to be desired. As more signals appeared on the bands, greater oscillator stability was sought. The need for improved stability embraced the use of quartz crystals, which solved the stability problem. Later on, the demand for multiple frequency channels increased and created a new set of problems requiring the use of many crystals in a single radio. The cost of the radio was driven upward as a result.

The answer to these problems was the development of the Phase-Locked Loop (PLL) synthesizer, which provided multiple frequency capability along with the stability of the quartz crystal at every generated frequency. The latest technology in frequency synthesis is called Direct Digital Synthesis (DDS) and differs greatly in design from the PLL system, yet the end result can be the same. Before discussing the DDS system, it is perhaps best to review the PLL system in order to establish a comparison of the frequency synthesis processes involved.

PLL synthesizer

Frequency synthesizers get their name from being able to generate a great number of discrete frequencies with the same stability as that of a quartz crystal while utilizing perhaps only one crystal (although more than one may be used in the synthesizer in order to meet specific design criteria).

A PLL synthesizer is shown in **Fig. 1**, in which a VCO (voltage-controlled oscillator) is used to generate the output signal. To set the VCO to a specific frequency, it is necessary to lock it to a stable frequency source, which, in this case, is a clock. A clock, in reality, is a quartz crystal oscillator. To make the PLL circuit function, the signal output of the VCO and the output from the clock are compared in a phase detector where the phase angle will always be 90 degrees when the VCO is locked to the clock. Should the VCO attempt to shift in frequency, the phase detector will develop a DC output voltage sufficient to steer the VCO back to a phase difference of 90 degrees. In other words, the VCO is phase-locked to the clock.

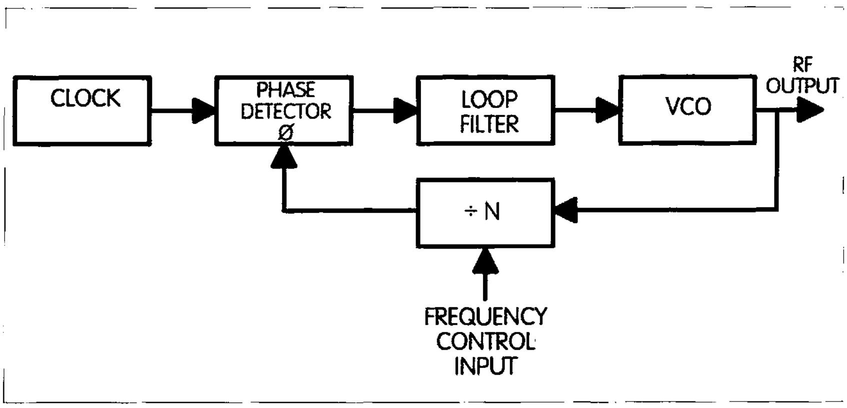


Fig. 1. Block diagram of a basic phase-locked loop system with the major functions shown.

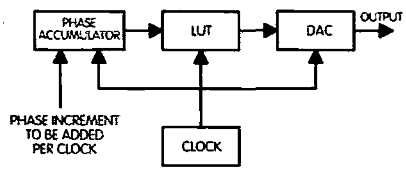


Fig. 2. Block diagram of a basic DDS with the major functions shown.

It isn't necessary that the clock and VCO be on the same frequency. In fact, they are rarely ever on the same frequency. To achieve a frequency separation and still obtain the 90-degree phase shift, the signals fed into the phase detector may be shifted to any design-convenient frequency, typically lower. A frequency divider is placed between the VCO output and the phase detector to create a frequency lower than the operating frequency of the VCO. In most cases, the frequency divider will have a variable divide ratio (divide by N) so that a multiple set of frequencies can be generated by the VCO with each output frequency phase-locked to the clock frequency. Incremental frequency steps are created by changing the divide ratio (N) through a set of switches.

Also included in a PLL system is a device called a loop filter. The purpose of the filter is to reduce the rate of VCO response to an output from the phase detector. Should the VCO response be too fast, it could swing too far (frequency-wise), get partially out of control, and then swing like a pendulum. The result would cause the VCO to swing back and forth at a fast rate. A loop filter is used to reduce the VCO response speed (or slew rate) in order for it to gain a phase-locked condition.

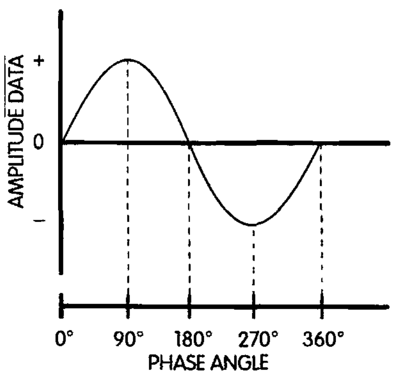


Fig. 3. The waveshape of the output signal from a DAC as mapped in the LUT.

PLL frequency synthesizers suffer from several problems, such as: (1) frequency resolution (large step values); (2) settling time (lock access timing); (3) bandwidth limitations (tunable range); and (4) phase noise (jitter). Most of these problems have been controlled sufficiently and are usually transparent to the user. However, PLL frequency stability is still an issue and is affected by two primary faults. The two faults are the stability of the VCO and the phase noise caused by a high divide ratio. This latter fault has essentially been solved through the use of a dual modulus synthesizer design.

DDS system

As important as the PLL synthesizer was to the evolution of radio communication, the latest synthesizer development solves many of the PLL problems and opens the door to many new applications, but adds a few problems of its own. The new synthesizer is called a Direct Digital Synthesizer (DDS), and a very basic one is shown in **Fig. 2**.

It is composed of four major components: phase accumulator, look-up table (LUT), digital-to-analog converter (DAC), and clock. The DDS is not intended to be a replacement for the PLL system, as each synthesizer has its useful merits for specific applications. In many new design applications, both the DDS and PLL systems come together and solve some of the ills associated with each if used alone.

In a DDS, the DAC creates an analog output signal based upon a defined amplitude which is presented as a digital word. As a result, any desired waveform can be generated by defining the input word to the DAC. Unlike other signal generators, the DDS does not require a resonant circuit, as the signal is generated as a voltage amplitude with respect to time.

Ahead of the DAC is an LUT, which is really the core of the DDS in that it maps the waveshape of the output signal as a function of phase angle from 0–360 degrees as shown in **Fig. 3**. An LUT is actually a ROM chip that is programmed to produce an amplitude at a given phase angle. The ROM mapping determines the waveform that will be produced, and it's possible that several waveforms can be mapped within the ROM with each at a selectable range of addresses.

In high frequency DDS systems, the LUT is usually made more efficient by programming it to define only the first 90 degrees of the waveform, since the remaining 270-degree portion can be generated by reflecting the first 90 degrees in different ways. The objective is to improve the resolution of the ROM response at the higher clock frequencies.

Ahead of the LUT is a phase accumulator, which is simply a counter or "adder" form of device that provides the input to the LUT. The phase accumulator is the rate controller, where the output frequency is controlled by the value added to the accumulator per each clock cycle. Consider an accumulator looking like P = P + X, where P = phase angle and X = the number of degrees to advance per step.

The sequence would continue, with P increasing by the value X from zero through 360 degrees of the output signal. At the completion of 360 degrees, the phase accumulator would roll over and start again from zero. Controlling the output frequency is then a matter of how often the sequence is to be repeated per unit of time. The actual input control can be done manually with coded switches, counter, ROM, or a microprocessor/microcontroller. More advanced systems use a microcontroller for application flexibility.

For a signal to be useful, we must define it in terms of frequency, phase, and amplitude. When all of these are combined with respect to time, the output waveform will be determined. In a DDS, each waveform is defined by and/or in response to a digital word. The greater the number of bits in the control word, e.g., 4, 8, 16, 32, etc., the higher the resolution of the DAC response. The LUT contributes to the signal definition by the number of

points of comparison (amplitude vs. phase angle) where the difference between the points of comparison creates some minor distortion or phase error. The amplitude approximations caused by the DAC's sampling points per clock cycle affect the output amplitude resolution.

The waveform and function (sweep, frequency hopping, modulation, etc.) are clocked through the DAC at a clock frequency which controls the upper frequency limit of the DDS, where the upper limit is one-half of the clock frequency (the Nyquist rate). Nyquist refers to the highest signal frequency that may be represented by a digital sampling method which is equal to one-half the sampling frequency (clock frequency).

The lower frequency limit of a DDS is near zero or about 1 Hz. Since the DAC works from sampling points, at one-half of the clock frequency (which is the highest output frequency), it has only two amplitude points (maximum and minimum) to work with in order to define the output waveform.

As an example of the upper frequency region, a 50 MHz clock allows the DDS to generate frequencies up to 25 MHz. The frequency step increment produced by the DDS is determined by the digital word, and it's possible to generate incremental steps with a DDS system down to fractional increments of one Hertz. It is common in modern communications equipment to have frequency increments in 1 and 10 Hz steps.

Modulation techniques

A DDS system can be modulated to create the same or similar modulation results obtained from one of the more common signal sources. Modulating a DDS is a matter of controlling the digital word format with respect to clock timing at the desired point in the circuit. **Fig. 4** shows the various circuit locations where an AM and FM modulation mode may be introduced. Any audio amplitude variation that can be translated to an instantaneous digital word change will modulate the DDS.

The placement of the word change within the circuit determines the modulation mode that will be created:

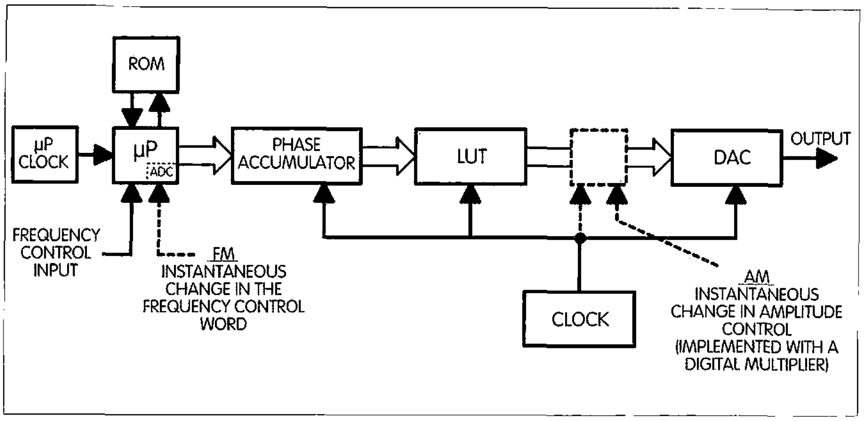


Fig. 4. Microprocessor-enhanced DDS with control points shown for creating AM and FM modulation modes.

•Frequency modulation (FM) requires that an instantaneous change be made in the frequency control word.

•Phase modulation (PM) is a phase shift phenomenon and may be introduced by creating an instantaneous change in the timing between the control word and clock.

•Amplitude modulation (AM) may be created by a word rate change at the input of the DAC. A digital multiplier is used to alter the word emitted from the LUT, which in turn causes the DAC to create a signal with an amplitude change following the desired amplitude modulation envelope.

Predictable output and shortfalls

Yes, there are some shortfalls with a DDS system such as spurious responses and alias frequencies. In comparison to a PLL, the phase response jitter of a PLL is not present in a DDS, but some spurious responses are produced in the signal output by the DAC. These spurious responses are caused by DAC decoding errors and amplitude approximations, the results of which are not predictable. Because the spurious responses occur close to the desired output frequency, they are very difficult to filter out. The most obvious problem with the DDS, however, is alias signals, which can be removed by

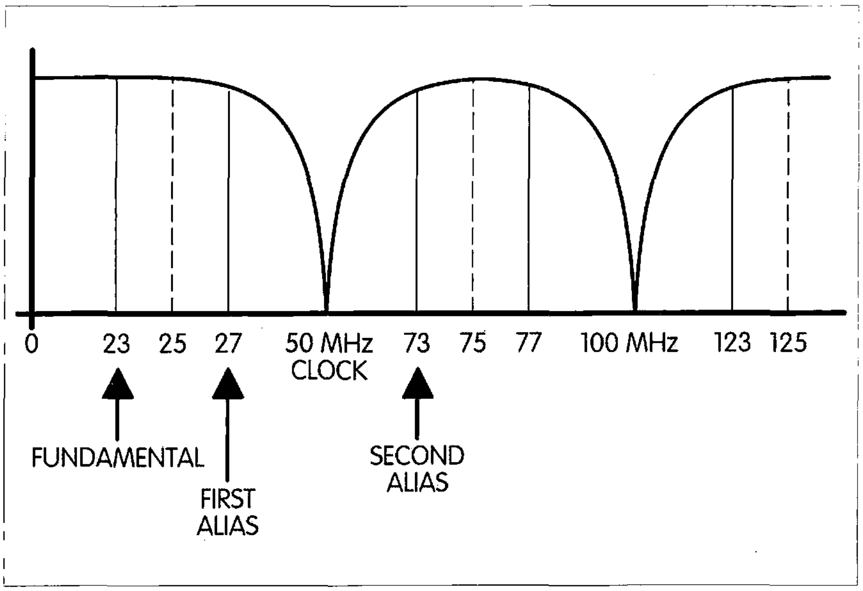


Fig. 5. DDS output frequency spectrum showing alias and harmonic frequencies.

filtering the output signal. Filtering of the output also improves the spectral purity of the signal by removing the alias signals and the DAC-imposed amplitude approximations.

However, with the alias filter removed, the DDS will provide predictable alias signals and harmonics well above the clock frequency, as shown in **Fig. 5**. The alias frequencies are found by adding and subtracting the fundamental output signal to/from the clock frequency. As shown, a fundamental frequency is being generated at 23 MHz, which is 27 MHz below the 50 MHz clock (27 = 50 - 23). Simultaneously, an alias signal is produced 23 MHz above the clock at 73 MHz (73 = 50 + 23). If the fundamental is shifted to 22 MHz, the alias frequencies will be 28 MHz and 72 MHz. A similar frequency set will be observed at each harmonic of the clock frequency.

Applications

The applications of a signal source are countless, regardless of the method used for generating the signal. However, a DDS especially lends itself as a natural for the following applications:

•Spread spectrum where frequency hopping is a requirement.

•Frequency and phase shift keying.

•Digital TV.

•Digital audio used with computers and compact disks.

•Signal generation requiring precise frequency settings and small incremental frequency steps.

•Frequency synthesis in communication radios.

•Use as the local oscillator in a receiver where the local oscillator frequency is offset from the displayed frequency to accommodate a receiver's IF.

•Test bench signal and waveform generator.

Regarding the signal and waveform generation capability of the DDS, it will generate most any repetitive waveform including a square wave. However, the square wave rise time at the highest output frequency of the DDS is compromised by the one-half clock frequency timing. The rise time improves as the output frequency is lowered.

Conclusions

A DDS can be programmed to produce many different waveforms at incremental frequency steps from a fraction of a hertz to larger step values. Because of its versatility, the DDS has created signal source design opportunities not previously available.

For those interested in using the DDS as a signal generator, the predictable outputs of the fundamental, harmonic, and alias frequencies are stable and suitable for use as identifiable signals. It must be noted, though, that the generation of multiple signals will be present within the frequency spectrum when an alias filter is not used. The addition of an alias filter to the output of a DDS will make it a superior frequency source having high signal and spectral purity because all signals generated above one-half the clock frequency will have been removed.

Sensitivity Training

Some pros and cons of increasing receiver sensitivity.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

It seems we're always scratching for a little more sensitivity, but sometimes our scratching just makes a bad situation worse. A low noise amplifier (LNA) can help in special circumstances, and those are usually found above 15 meters. In the HF range below 20 MHz, the noise the signal is competing with is primarily manmade, but atmospheric noise produced by lightning discharges in thunderstorms can be a major problem depending on the time of day, season, weather, location, and frequency. The QRN on 160 meters and 80 meters in the summertime can be a bear. Manmade noise is an inverse function of frequency and depends on location, in that it is due chiefly to electric motors, neon signs, power lines, ignition systems, and the ubiquitous TV receivers' sweep generators. Above 30 MHz, manmade noise is about equal to thermal noise.

Thermal noise is generated in the thermal agitation of electrons in a resistance and is independent of frequency. The electron or hole flow in a transistor or the electrons flowing from cathode to plate in a vacuum tube are discrete units of charge occurring randomly. Their sum makes up the DC current, and their RMS value makes up the AC value. The AC component exhibits all of the characteristics of thermal noise. The RMS variation of transistor current is difficult to predict, and only under special circumstances such as in temperature-limited diodes can it be defined statistically. Thermal noise power (watts) available from a resistor is expressed as kTB, where k is Boltzman's constant, 1.38×10^{-23}. T is the absolute temperature in degrees Kelvin (room temperature is about 300° K), and B is the noise bandwidth in hertz (essentially the 3 dB bandwidth). kTB has a value of -203 dBW or -173 dBm per hertz. In a 1 kHz bandwidth, the noise power is -143 dBm.

The maximum available power from a generator is obtained when the load resistance equals the generator's resistance. Therefore, the RMS value of the noise voltage from a resistor R is:

$$e_n = \sqrt{(4kTBR)}$$

The radiation resistance of an antenna produces thermal noise, which is the minimum signal available from the antenna. As far as the receiver is concerned, noise from the antenna is just more signal. The noise the desired signal must compete with is the sum of the antenna's noise and the noise generated within the receiver. We can't do anything about the noise generated by the antenna, but the noise generated in the receiving system is a different story. We can increase the antenna's signal and noise to a level that overrides the receiver's internally generated noise. Generally, we are stuck with the receiver's internal noise, but some receivers are better than others.

The sensitivity of HF receivers is often given in terms of the RF signal at the input of the receiver needed to produce some signal-to-noise ratio S/N at the output. For example, an HF receiver may be specified as 0.5 µV for 10 dB S/N. VHF and UHF receivers usually specify the sensitivity in terms of "Noise Figure" or "Noise Factor," which is a comparison of the equivalent noise at the input of the actual receiver to the noise at the input of a perfect noisefree receiver when fed by a generator with a matching source resistance.

The noise factor of a network or "black box" can be defined as follows:

$$F = (S / kTB) / (S_o / N_o)$$

where
F = noise factor of the network
S = signal power available from the source
S_o = signal power available from the network
N_o = noise power available from the network
k = Boltzman's constant
T = absolute temperature of the signal source
B = noise bandwidth of the network.

The network is an undefined "black box" that can be active or passive and have a gain of greater or less than one. kTB represents the noise available from a resistor (the signal source's resistance) of arbitrary value at a temperature T and is merely a restatement of the usual expression for Johnson noise. The qualitative meaning is that a signal, no matter how it arises, has associated with it at least a minimum amount of noise, kTB. If the signal passes through a network that does not add noise, the ratio of signal power to noise power at the output will be the same as the signal-to-noise ratio at the input and the noise factor will be unity.

Noise figure NF is simply noise factor F expressed in dB, or NF = 10 x log F. The receiver's noise factor is usually determined by its first one or two stages, and is obviously a function of the receiver's design. The overall noise factor F of two cascaded networks is expressed as:

$$F_{12} = F_1 + (F_2 - 1) / G_1$$

where
F_1 = the noise factor of the first stage
F_2 = the noise factor of the second stage
G_1 = the power gain of the first stage.

When G_1 is large or F_2 small, the overall noise figure is essentially F_1. When G_1 is small, the noise factor of the second stage assumes greater importance.

For example, if the transmission line between the antenna and the receiver is considered the first network, F_1 may be 1 but transmission line losses make G_1 less than one and transmission line losses become critical.

The losses per foot in the transmission line are dependent on frequency and the construction of the line. At 150 MHz, RG-58 has about 7 dB loss per 100 feet and about 3 dB per hundred feet at 15 MHz, while 3/4-inch hard line has less than 1 dB loss at 150 MHz. Cable losses of RG-58 on two meters can be significant when the run between antenna and receiver is long. The cable may have a noise factor of one but the gain is low—7 dB loss is a gain of 0.2. The overall system noise factor for a receiver with a noise factor of 10 dB (noise factor of 10) fed with coax with a loss of 7 dB (gain of 0.2) is:

$$F_{12} = 1 + (10 - 1) / 0.2 = 1 + 45 = 46$$

$$NF = 10 \times \log 46 = 16.6 \text{ dB}$$

The noise figure of the receiving system is increased essentially by the loss of the cable. When the cable is preceded by a preamp, the equivalent preamp gain is simply reduced by the cable loss, but its noise figure is unchanged. A preamp with an NF of 4 dB and a gain of 28 dB driving a cable with 7 dB loss looks like a preamp with an NF of 4 dB and a gain of 21 dB.

A good preamp at the antenna terminals can also improve the sensitivity of a mediocre receiver. To improve the situation, the noise figure of the preamp must be lower than the receiver's noise figure and the equivalent preamp gain must be greater than one. Good VHF receivers have noise figures in the 3 to 6 dB range, while excellent GaAsFET preamps have noise figures in the range of 1 dB and provide gains of 20 dB. Consider a receiver with a noise figure of 6 dB (F = 4), 7 dB cable loss (G = 0.2), and a preamp with a noise figure of 2 dB (F = 1.6) and 15 dB of gain. The equivalent gain of the preamp is 8 dB (G_1 = 6.3) and the overall noise factor with the preamp is:

$$F_{12} = 1.6 + 4 / 6.3 = 2.07 = 3.17 \text{ dB}$$

If the preamp's noise figure were 4 dB (F = 2.5), the overall noise factor would increase to 2.97 (noise figure of 4.7 dB). Without the preamp, the noise figure would be:

$$F_{12} = 1 + (4 - 1) / 0.2 = 16 = 12 \text{ dB}$$

The preamp reduces the overall noise figure from 12 dB to 4.7 dB, a significant improvement.

TV preamps or boosters from Radio Shack™ are not very expensive and can overcome long cable losses at VHF and UHF. For example, RS #150-1960, Cable TV Amplifier, at this writing under $30, has a bandwidth of 54 to 500 MHz, an NF of 6 dB, and a gain of 20 dB. This VHF/UHF preamp in front of a 6 dB receiver and 7 dB of cable loss offers a noise factor of 4.13 or noise figure of 6.16 dB. Without the preamp, the noise figure would be about 16 dB. Again, a worthwhile improvement.

HF receivers are usually spec'd as the input signal required to produce some output signal-to-noise ratio (S/N). An HF receiver whose sensitivity is specified as 0.5µV for 10 dB S/N in a 2 kHz bandwidth from a 50 Ω source can be converted to an equivalent noise factor. The 10 dB S/N implies an S/N of 3.16:1 or 0.5 µV of signal to 0.16 µV of noise at the input. The equivalent noise power E^2/R at the input is 5.12^{-16}, while the thermal noise kTB is 8.28×10^{-18} for a 2 kHz bandwidth. The receiver's internal noise is about 62 times greater than thermal noise, and the noise figure is about 18 dB. A VHF receiver with a noise figure of 18 dB would be considered a clunker, but that figure's not too bad for an HF receiver. In the 40-meter band the man-made noise is some 40 or 50 dB greater than thermal noise, so a receiver noise figure of 20 dB does not limit sensitivity. At 10 meters, the situation is quite different. Man-made noise and atmospheric noise are about equal to thermal noise, and the receiver's internal noise does limit sensitivity. From this it can be concluded that a low-noise preamp can be beneficial at 10 or 15 meters, but below 20 meters the improvement in sensitivity is negligible.

In fact, a preamp's gain is no advantage below 20 meters. A preamp can increase the signals at the input of the

receiver, true enough, but these higher signal levels are more likely to overload the receiver and generate distortions that appear as false in-band signals. Of course, a step attenuator in front of the receiver can negate the preamp's effects as if the cable losses were increased. A resistive attenuator is recommended over gain control of IF or RF stages in the receiver because the attenuator is passive, linear, and located at the lowest signal point. Many HF receivers have a switched 20 dB attenuator at the input to ease the overload potential. The attenuator actually increases the dynamic range: the maximum signals the receiver can handle don't change, but the minimum signals are reduced to near the receiver's internal noise, so the ratio of max to min increases.

The step attenuator shown in **Fig. 1** has three 10 dB steps, for a total of 30 dB. The resistor values for a 50 Ω step attenuator are given in **Table 1**. For a 75 Ω attenuator, multiply the values given in **Table 1** by 1.5. Of course, additional attenuator sections or different attenuations can be used if desired. The maximum attenuation that can be obtained in one step is determined by the capacitive coupling across the switch contacts. With ordinary DPDT toggle switches, the maximum attenuation is less than 40 dB at 30 MHz. R_1 is the series resistance and R_2 is the input and output shunt resistance of any one attenuator section. An attenuator with a total attenuation of 30 dB maximum is probably adequate for most situations. If the attenuation is set so that noise can be comfortably heard with maximum receiver gain, you won't miss any signals and you'll have the maximum dynamic range.

Even good HF receivers often suffer from poor sensitivity on 10 and 15 meters; typical values are 0.25 µV for 10 dB S/N (12 dB NF). A moderate preamp can overcome the sensitivity shortcomings of a poor 10-meter receiver. For example, a preamp with a noise figure of 4 dB and effective gain of 20 dB can improve the noise figure of a receiver with a 16 dB NF to about 4.6 dB. That's like multiplying the number of elements in your beam by nine or 10.

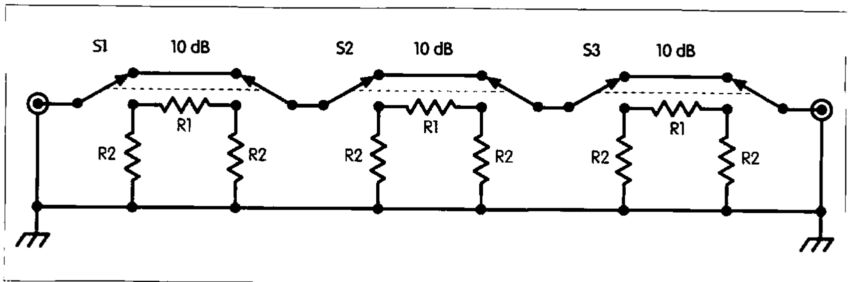


Fig. 1. A step attenuator is a coarse gain control.

A preamp can be built with discrete transistors or with hybrid amplifier modules such as the Motorola MWA110. While a preamp using a 2N5460 JFET can have a spot noise figure as low as 1 dB up to 400 MHz, obtaining a broadband match without introducing excessive losses is a challenge. There is much to recommend the MWA110 hybrid amplifier: wide bandwidth, respectable noise figure, and 50 Ω input/output resistance. The inherent stability of the hybrid modules makes possible the cascading of two or more units without oscillatory problems. An MWA110 is specified to have a bandwidth from DC to beyond 400 MHz, a gain of 14 dB, an NF of 4 dB, and 50 Ω input and output resistances. The 4 dB noise figure isn't great, but it's not bad considering the bandwidth. Two MWA110s in cascade have an overall NF of 4.1 dB and a gain of 28 dB. When a two-stage preamp made with MWA110s precedes a receiver with a 16 dB noise figure, the overall noise figure is about 4.3 dB. At 2 meters, where line losses are 7 dB and the receiver's noise figure is probably less than 10 dB, the overall noise figure improves to 4.2 dB or better.

The internal circuit of the MWA110 and the schematic of a single-stage amplifier are shown in **Fig. 2**. At VHF and above, the input/output impedance levels are most easily preserved on a circuit board by using 50 Ω microstrip transmission lines. **Fig. 4** is an example of a two-stage MWA110 amplifier which uses microstrip lines in conjunction with other sound RF construction techniques.

The construction of VHF circuits need not be difficult or magical if you keep in mind that parasitic capacitance and inductance accompany every component, and that the resistance of conductors is increased by skin effect. These effects must be accounted for—ignore them at your peril. The parasitic capacitance and inductance are independent of frequency but, of course, their reactances are dependent on frequency. For example, a one-inch piece of #20 AWG copper wire has an inductance of about 20 nH; at 400 MHz, that's an impedance of about 50 Ω. The lead inductance of capacitors and their capacitance makes an effective series-resonant circuit: A 0.01 µF disc ceramic with half-inch leads resonates at about 10 or 12 MHz; with sixteenth-inch leads, it resonates at about 30 MHz. A strip of copper has lower inductance than a round wire: A one-inch-long copper ribbon a quarter-inch by two thousandths of an inch (the cross section area of #22 AWG) has an inductance of about 12 nH. Skin effect

Continued on page 22

Atten.	Shunt Arm	Series Arm
dB	R2 (ohms) *	R1 (ohms) *
3	294	17.8
10	95.3	71.5
20	60.4	249
* nearest 1% values		
dB	R2 (ohms) **	R1 (ohms) **
3	300	18
10	100	75
20	62	240
** nearest 5% values		

Table 1. Resistor values for a 50 Ω step attenuator.

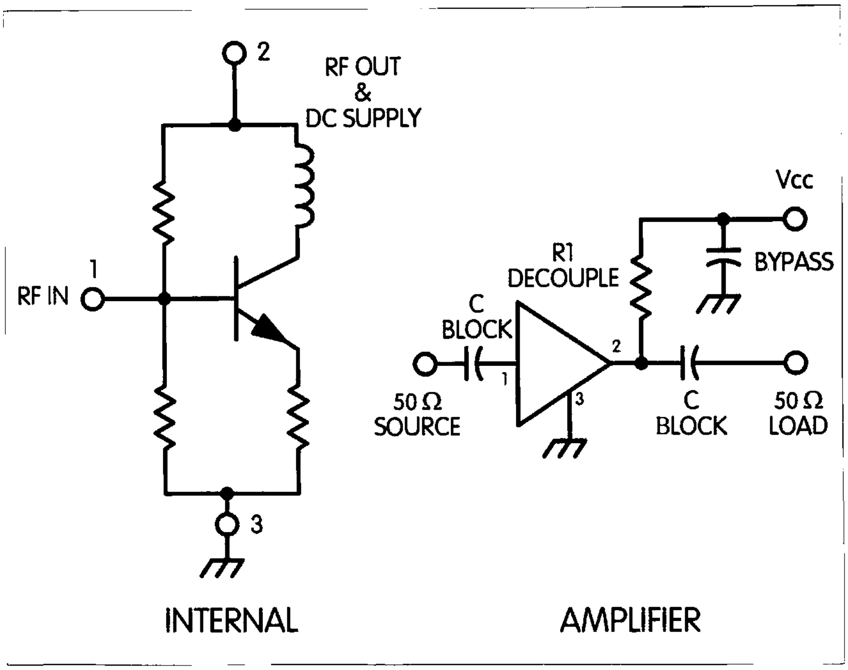


Fig. 2. The internal circuit of the MWA110 and its application as an amplifier.

Sensitivity Training
continued from page 21

increases the resistance of a conductor when the conductor's inductance crowds the current to the outermost surface of the conductor so that the current-carrying cross-sectional area is decreased and the resistance increased. Skin effect is a function of frequency, permeability (μ) of the conductor, and the conductivity (σ) of the conductor. The critical depth δ where 63% of the current is concentrated is:

$$\delta = \sqrt{(1 / 2\pi F\sigma\mu)}$$

where
δ = critical depth in meters
F = frequency in Hertz
μ = permeability in Henrys per meter (for copper, μ is 12.56×10^{-7})
σ = conductivity in Siemens per meter (for copper, σ is 58×10^{6}).

These skin effects lead to DC ground not necessarily being RF ground. At RF, a ground plane should be used as opposed to a ground point. A ground plane is by definition a plane in which all points have the same potential: The inductance and resistance between two points on the ground plane is zero. At DC or low frequencies, the inductance or resistance of a wire can be essentially zero and a point can be the reference ground.

The power gain of the MWA110 is 14 dB when device current is 10 mA and V_D is 2.9 V. When V_{cc} is 12 V, the decoupling resistance R_1 in **Figs. 2** and **3** must drop 9.1 volts. Therefore, R_1 must be 910 Ω. The amplifier shown in **Fig. 3** uses 50 Ω microstrip lines at the input and output of the MWA110. The DC components are on the ground plane side of the board, while the RF components are on the other side. The DC blocking capacitors C_1 isolate the amplifier from DC voltages on the input and output. C_1 and the 50 Ω input resistance act like a high-pass filter whose low cutoff frequency is 1/2π50C1. When the C_1s are 220 pF, the low-frequency cutoff is 14.4 MHz; when the C_1s are 1000 pF, the low frequency cutoff is below 3.5 MHz. C_1 is a leadless 220 pF chip capacitor similar to Kemet p/n C0805C221J5GAC. C0805C102K5RAC can be a 1000 pF chip capacitor C_2 that bypasses the higher RF current in R_1 to the ground plane. C_3 is a 0.01 µF chip capacitor similar to Kemet C0805C103K5RAC that bypasses the lower frequency currents in R_1 to the ground plane.

Each C_1 causes the power gain to fall 3 dB per octave below the cutoff frequency, 6 dB per octave. When all three C_1s are 220 pF, the response is down 9 dB at 14.4 MHz and down 18 dB at 7.2 MHz. Man-made noise rises about 20 or 30 dB in that octave. The increased noise and falling preamp gain will just about cancel out, and noise to the receiver will remain about the same. The resistors R_1 are 1/4 W carbon composition equivalent to MIL R-11 RC07GF911J. The R_1s are mounted on the RF side of the circuit board between the microstrip near pin 2 to the V_{cc} patch. R_1 should be dressed down on the circuit board and soldered to the microstrip and the V_{cc} patch. Through-holes are not needed. L_1 and L_2 are Ferroxcube shielding beads 56-590-65/4A on #26 AWG wire. L_1 is a single turn and L_2 is two turns.

In passing, note that every pass of the wire through the bead's hole is one turn. The circuit board is one ounce (0.0014 inches thick) double-sided copper on 0.0625-inch Fiberglas™ epoxy (dielectric constant of 5), with the top side, which would normally be the component side, being the ground

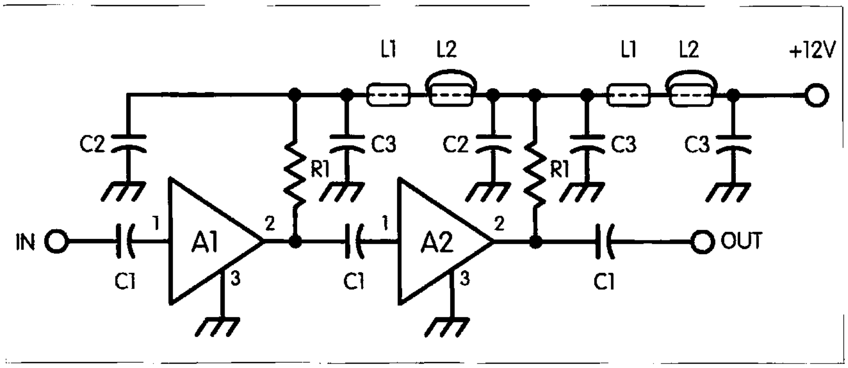


Fig. 3. Two MWA110s produce a broadband preamp.

plane. The ground plane is continuous except for reliefs around pins 1 and 2 of the MWA110s and around the through-holes for L_1 and L_2. The bottom (track) side is the RF side. The top and bottom ground areas are interconnected with #20 AWG hairpin-shaped "U" bars soldered to both top and bottom ground areas. Of course, plated-through holes can be used instead of "U" bars. The number and location of the "U" bars is not particularly critical, but prudence indicates their use near pin 3 of the amplifiers, the bulkhead connectors, C_2, and C_3 to ensure that the ground areas are all at the same potential. The inductance of a "U" bar is about 0.2 nH, and its reactance is less than an ohm even at 400 MHz.

The characteristic impedance Z_0 of the microstrip lines is a function of the circuit board's dielectric constant, thickness, and conductor width. A Z_0 of 50 Ω is obtained with one-tenth-inch conductor widths on the 0.0625-inch circuit board. The width of the striplines is critical, but not the length. Sharp bends in the lines can introduce discontinuities in the impedance and are better avoided. The MWA110 is mounted snugly down against the ground plane side of the board, and through-holes pass the leads through the ground plane to the microstrip. The case of the MWA110s is connected to pin 3 and may make contact with the ground plane, but it need not be soldered.

The schematic of a two-stage preamp using MWA110s is shown in **Fig. 3.** It is very much like the amplifier shown in **Fig. 2**, except for the decoupling in the V_{cc} line. **Fig. 4** shows the stripline and the physical layout of the circuit board; the scale is approximately 2:1.

Continued on page 24

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Wayne has a whole bunch of booklets you'll enjoy — like How to Make Money, The Bioelectrifier, WWII Submarine, Caribbean, and other Adventures, Editorial Collections, Instant Morse Code Course for the truly lazy, Reading Guide, Cold Fusion, etc. Ask for the FREE 16p list of WAYNE'S STUFF. Order **Wayne's Stuff**

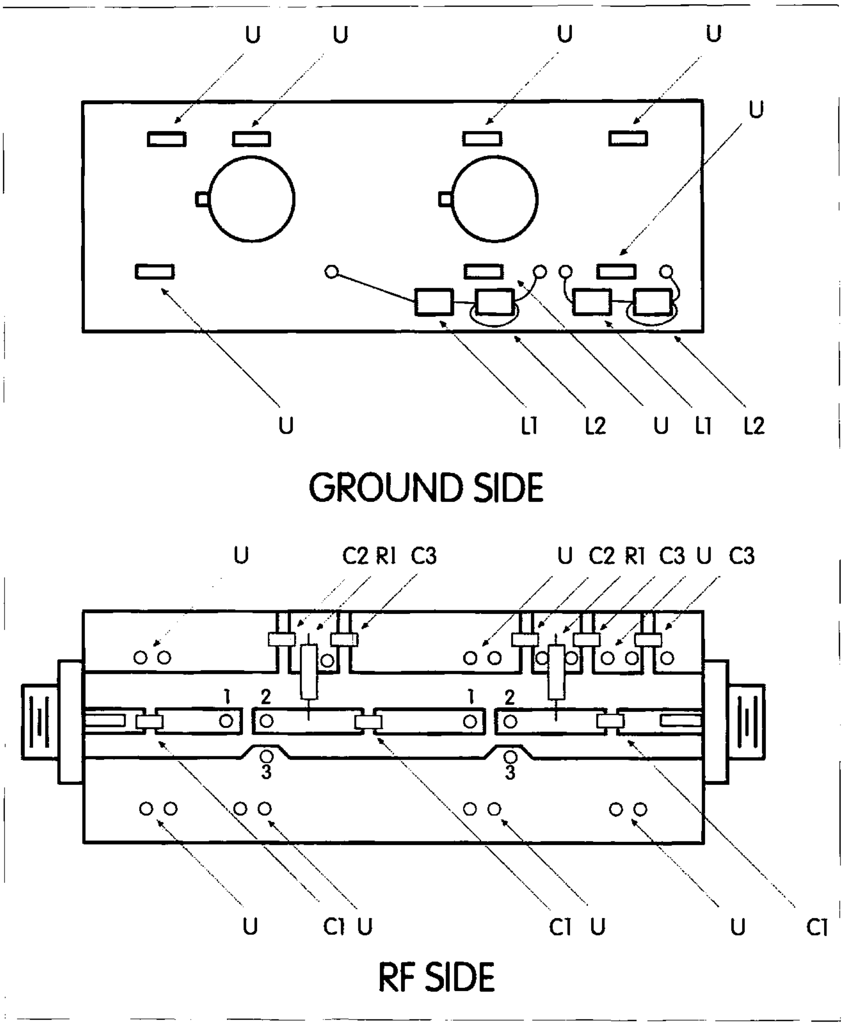


Fig. 4. A two-stage amplifier can be built in stripline.

Sensitivity Training
continued from page 23

When the amplifier modules are spaced an inch or so more apart, no interstage shielding should be necessary. The preamp board should be mounted in a shielded box and the length of the circuit board made long enough to fit between the center pins of the bulkhead connectors. The flanges of the bulkhead connectors should be soldered to the ground areas of the circuit board.

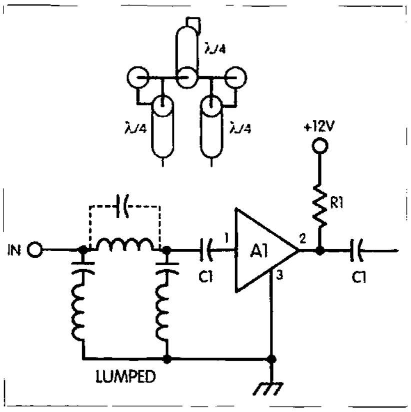


Fig. 5. A notch filter can reduce interfering signals.

The shield box is necessary to protect against the weather and extraneous signals that might be picked up. Note that the enclosure can look like a waveguide or cavity and support waveguide coupling between the input and output as well as provide a means of undesired feedback. The coupling is not likely to be tight enough to be a problem if the connector center pins are soldered directly to the stripline and the decoupling resistors R_1 are dressed against the circuit board. +12 V should be introduced to the circuit board at the output end of the board. The board is light enough to be supported by the center pins of the connectors and no extra mounting support should be needed for fixed installations. When used in a high-vibration environment, some extra support may be needed.

The advantages of a preamp at VHF and UHF are apparent when there are high transmission line losses or when the receiver's noise figure is high. The broadband preamp described can be used for all bands up to 440 MHz without band-switching. If there is a strong FM or TV signal to contend with, a notch filter will be required in front of the first stage to knock the big interfering signals down to tolerable levels. The filter shown in **Fig. 5** can be made in coax between the antenna and the preamp or with lumped constants on the circuit board. The input impedance of a quarter-wave transmission line is an open circuit when the output end is shorted, and is a short-circuit when the output is open.

A typical lumped-constant filter is shown in **Fig. 5**. The tuned circuits resonate at the frequency of the interfering signal. For frequencies below 150 MHz, the quarter-wave lines are longer than 19 inches. For lower interfering frequencies, lumped constants are more appropriate. The inductor for the parallel-tuned circuit can be wound on a 1/4 W 10 kΩ resistor used as a coil form. Ideally, the inductor of the parallel-tuned circuit is self-resonant at the frequency to be rejected, and the shunt input and output series-tuned circuits are series-resonant capacitors. If wound coils are used, their axes should all be mutually perpendicular.

Most HF receivers don't shine at 10 and 15 meters, and a preamp can help there. But below 20 meters, the extra gain is no help and can actually be a hindrance. In the preamp shown, the gain below 20 meters is reduced by the DC blocking capacitors C_1. When the C_1s are 220 pF, the preamp gain begins to roll off at about 14 MHz where the extra gain is no advantage. A receiver's sensitivity can be improved with the judicious application of a low-noise preamp. The key word is judicious. Mae West wasn't talking about preamps when she said, "Too much of a good thing is just enough."

Joy's "Loud Enough" Metronome, Part 2

Mr. Gizmo puts it all together.

Evert Fruitman W7RXV
2808 West Rancho Drive
Phoenix AZ 85017-2646
[fruitman@asuchm.la.asu.edu]

Last time, you'll recall, we went through the story of why I decided to build a metronome that my daughter could hear over the sound of the piano—one that could be set for any beat. Part 1 included the schematics and parts lists: now let's put it together.

Note: **Figs. 1–5**, **Tables 1–3**, and **Photo A** were all included in Part 1, published in April's *73*.

Fig. 3 (remember it from last time?) lends itself to just about any type of construction that's agreeable to you. **Photo B** shows the interior of the basic bare-bones, blue-box metronome, with eight presets. An inexpensive card file box comfortably houses the parts. This particular model has eight presets plus the adjustable tempo control. It uses a piece of perfboard to hold the main part of the circuit. The second piece of perfboard holds the adjustable and fixed resistors for the preset times. I mounted it on the back of the preset switch.

Mounting the board by its leads avoided the problem of having to run a small bundle of wires. You could put the entire circuit on a single piece of perfboard. You may want to start by putting the 7805 regulator on the board and then the protection diode. Without that diode, turning off the power would allow C3 to discharge back through the regulator, destroying it. If you use the preregulator of **Fig. 5(a)**, you will not need the protection diode.

Following that, put on the capacitors and the resistors. Then run the wires from the board to the various controls and to the LED.

Hot LED?

You may wonder about the value I picked for the current-limiting resistor for front-panel LED1. Normally, you would subtract the 1.2–2 volts dropped in the LED from the supply voltage. Then divide that by the current you want in the LED.

We can look at a quick example. 9 V – 1.8 V = 7.2 V. The series resistor will have to drop 7.2 volts at 10–15 mA (0.01–0.015 amps). Using 12 mA and dividing that gives a resistor of 600 ohms. The nearest standard values are 560 and 680 ohms.

In a normal circuit, that would work. But, remember, this is a pulse circuit. The pulse, *tock*, lasts only four milliseconds (0.004). Although the LED can respond to pulses many times shorter than that, it does not give off a

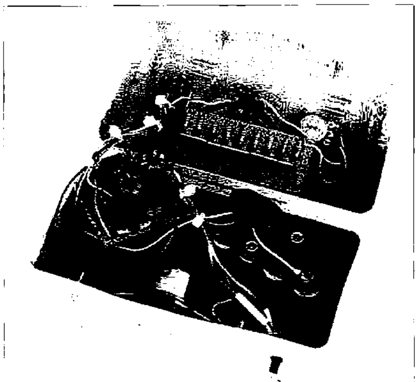


***Photo B**. Inside a basic, bare-bones, blue-box metronome with perfboard construction and eight preset tempos. A close look at the battery pack will show a tap, one way to get the correct voltage to Q1 and Q2 before trying the regulators. This does work while the batteries are fairly fresh. However, it does not give the best repeatability—sometimes that is a consideration.*

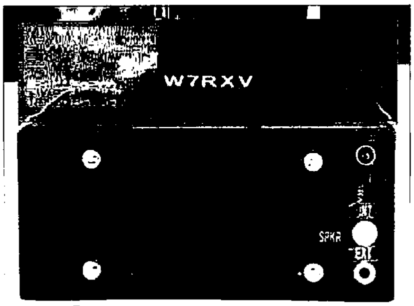


Photo C. Metronome in better-grade card file box, showing results of taping graph paper to box for layout. LED1, upper right, flashes in step with tocks, or silently if INT/EXT speaker switch is set for EXT and no external speaker is connected.

useful amount of light under these conditions. So, with the nominal 47–68 ohms that I used, it gives off a good light. And the LEDs have survived the short, but large, current pulses.

Another way

Photo C shows another way to build the circuit. It uses a better-grade card file box and shows the results of taping a piece of graph paper to the front of the box. This gave evenly spaced marks for drilling the holes—unlike **Photo D**, the deluxe version with 36 presets, which needed a grill to cover the irregular holes in the box. This metronome without presets, **Photo C**, has the simple three-volt regulator.

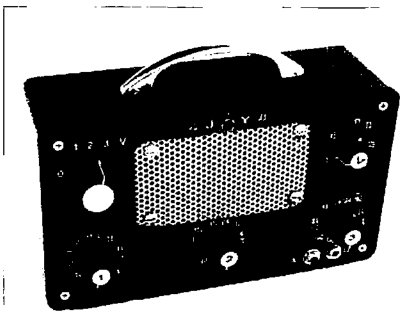


Photo D. Deluxe version of "loud enough" metronome has 36 preset tempos plus variable control. Small LEDs next to the switches and variable control give a dim but visible reminder of which one you selected. Note one LED to the left of the "V" knob for the variable control, and three others to the left of presets knobs 1, 2, and 3, underneath the numbers 44, 88, and 144, respectively.

You may choose to make a PCB layout with tape, as I did for the unit in **Photo A** (Part 1), or to make your unit with perfboard, in which case **Photo B** might be of help.

Box layout

Once you have picked up the parts, you may want to lay out where the controls will go on the box. The photos suggest a layout for the various versions, theme and variations, if you will. Here again, a piece of graph paper taped to the top or to the front of the box can be most helpful. Either the common four-squares-to-the-inch or the 10-squares-to-the-inch kind works well. Pencil in what you want and where you think it should go. Putting it in pencil on the paper makes it easy to make changes. When you settle on a layout, start drilling.

The hard plastic card file box drilled without too much danger of cracking. However, I did use a small drill for pilot holes just to stay on the safe side. While you can get other card file boxes at supermarkets or variety stores, you will probably have to go to an office supply store for a better-grade box. Although it costs about double what the other box does, it did get favorable comments from Joy. Besides that, my wife even let me decorate the piano with this one!

Less decorative

Although these metronomes give a good, loud *tock*, they will give a much louder sound when you plug a larger speaker into them. Most of us like the smaller, more portable unit. However, you can just build the electronics into a larger speaker box. That would make a pianotop or desktop model.

We found that a six-inch speaker gave more than enough sound for a flute quintet to use during a practice session, notwithstanding the conductor's apology for the noise.

When you finish the box, you will have an idea of how many wires will go from it to the board, and about how long to make them.

Check-out time

When you finish the board and have run wires to the speaker, the tempo control, and the battery, you can run a quick test. Before hooking up a battery, double-check to see that the voltage regulators and the transistors are wired properly. Also, double-check the timing capacitor, C2. You want the plus side of the capacitor to go to the base of Q1 and the minus side to the collector of Q2—not to common.

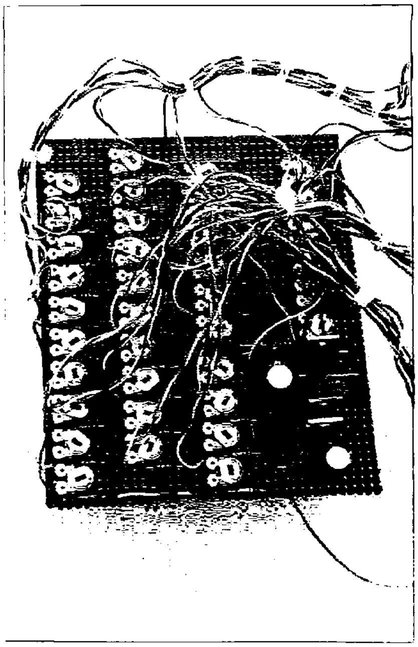


Photo E. Overall view of board in deluxe model. The regulator and pulse generator are on the lower right side of the board, while the fixed resistors and their trimmers take up the rest of the space.

Metronome Marks		
40	92	152
44	96	166
48	100	168
52	104	176
56	108	184
60	112	192
63	116	200
66	120	208
72	126	214
78	132	220
84	138	226
88	144	238

Table 4. Metronome marks.

Metronome Marks	Period
40	1.5
46	1.3
52	1.15
60	1.0
66	0.909
72	0.833
78	0.769
84	0.714
90	0.667
96	0.625
102	0.588
108	0.555
114	0.526
120	0.5
126	0.476
132	0.4545
138	0.435
144	0.416
150	0.4
156	0.385
162	0.37
168	0.357
172	0.349
178	0.337
184	0.326
190	0.316
196	0.306
202	0.297
208	0.288
214	0.28
220	0.2727
226	0.265
232	0.258
238	0.252
244	0.246
250	0.24

Table 5. Metronome marks and periods. To get period, divide the metronome mark into one and multiply by 60. One divided by 40 = 0.025. Then, 0.025 x 60 = 1.5. Adjust the trimmer so that the counter, in the period mode, reads 1.5. If your teacher likes other marks, use those.

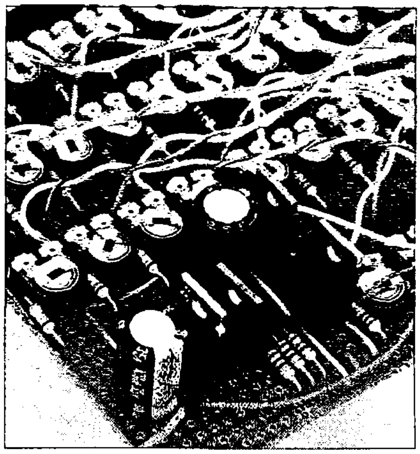


Photo F. Close-up of board in deluxe model. Large caps are C3 and C4. Transistors Q1–Q3 are seen left to right in a row, with the 7805 regulator above Q3.

Connect a wire from the battery plus, 9 V for the first test, to the *input* of the 7805 or the LM317. Connect the minus to the common line. If you have a multimeter with a nominal 300 mA range, connect it between one side of the battery and the circuit. The LED, the speaker, or both should give pulses. If they do not, but the meter does, or the meter shows a high, steady current, remove the battery leads and recheck the wiring. If the meter pulses, check the wiring to the amplifier stage.

Remember, the LED will light only if it has the plus side going to the battery plus. Normally, the longer lead is plus on the LEDs. You may connect a 1000–4700-ohm resistor, the LED, and a nine-volt battery in series to verify the LED connections. Although you can solder directly to the LED wires, I usually take a couple of pins out of a machine-pin IC socket and use them for the connections. That makes it easier to get the wires on the right way.

Calibration

Once you have it ticking, you will want to calibrate your metronome. You can use the tried, true, but tiring method. That means count the pulses

Continued on page 80

The Taylor Vee 20m Antenna

"Anything you don't understand must be magic!"

T.L. Poindexter WA5NPQ and
Singleton C. Taylor KB5IAY
8325 Wasson Road
Shreveport LA 71107

This antenna was designed by Singleton Taylor KB5IAY, as an effort to solve two of the most common shortcomings of simple low-cost antenna systems for 20 meters: lack of real estate and difficulty of SWR adjustment. There was another fairly serious design constraint, as well, readily understood by most hams—limited hobby funds.

The antenna was designed as an inverted vee, allowing it to fit into an available side yard, among several other antennas already in place. The inverted vee is a standard dipole antenna, with the ends drooping down from the center feedpoint.

Since dipoles have somewhat directional antenna patterns, with maximum radiation at right angles to the plane of the conductors, fairly deep nulls exist off the ends of the antenna. This was addressed by mounting the antenna on a PVC pipe framework, and using a light-duty Radio Shack™ TV antenna rotator to rotate the entire assembly.

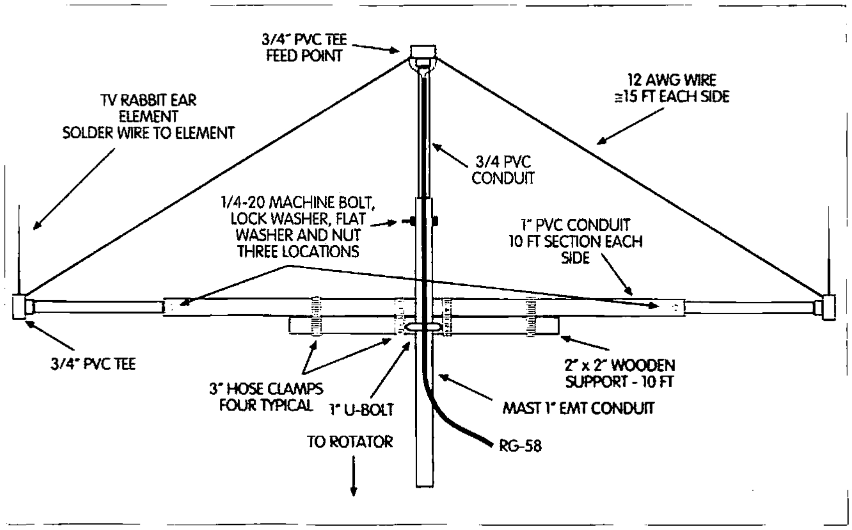


Fig. 1. The Taylor Vee (drawing not to scale).

Build simply

The entire assembly is mounted upon a five-foot piece of two-inch EMT conduit, driven about three feet into the ground. See **Fig. 1**. The main vertical support is a single 10-foot joint of one-and-one-quarter-inch EMT conduit, slipped inside the two-inch EMT ground support.

The Radio Shack rotator is mounted at the top of this conduit. The entire antenna assembly support framework is then mounted to the rotator.

The vertical support for the center feed of the antenna is a 10-foot joint of one-and-one-quarter-inch EMT conduit, clamped into the rotator. The top of this vertical support is split for about six inches, and a single joint of three-quarter-inch PVC conduit is slip-fitted into the joint and clamped with pipe clamps to extend the vertical support an additional three or four feet.

A three-quarter-inch PVC tee is mounted at the top of this three-quarter-inch PVC extension. It becomes the support for the antenna feedpoint.

Parts List

Qty.	Description
2	1" PVC pipe, 10-ft. length
1	3/4" PVC pipe, 10-ft. length
1	2" x 2" wood, 10-ft. length (crossarm)
1	1-1/4" U-bolt
4	Hose clamp to secure PVC pipe to crossarm
2	5/16" x 1" machine bolts with nuts
3	3/4" PVC "T"
1	Light-duty TV rotator (RS# 15-1225)
50 ft.	Rotator cable, 3-conductor (RS #15-1149)
scrounged rabbit ear antenna	
1-1/4" EMT conduit for mast, length dependent upon height	
#12 AWG THHN antenna wire (approx. 30 ft. required for 20 m antenna) Total length of antenna = #12 AWG + rabbit ear extensions. L = 468/freq in MHz.	

Table 1. Parts list.

Just above the rotator, the horizontal support is mounted to the one-inch vertical EMT conduit. The horizontal support is formed of two joints of one-inch PVC conduit, joined by a PVC coupling. This, in turn, is supported by a 10-foot section of 2 x 2 lumber, U-bolted to the vertical pipe. The one-inch PVC is secured with hose clamps to the 2 x 2 horizontal support in four places.

The horizontal support is further extended by slip-fitting a three-foot section of three-quarter-inch PVC pipe into each end of the one-inch PVC horizontal support and gluing a PVC tee onto each end of this three-quarter-inch PVC horizontal support, with one port pointing up. The tees are the attachment points for the antenna ends, and mounting for the VSWR adjustment elements. The three-quarter-inch PVC extensions, with the PVC tees attached, are secured into the one-inch horizontal supports by one-quarter-inch bolts through holes drilled through both PVC pipes.

Details, details ...

The basic antenna is built from 12 AWG THHN insulated electrical wire, available at any hardware store. The drooping radials are attached to each side of the PVC tee, mounted at the top of the vertical support, and the coax feedline is soldered directly to the antenna elements. Since only low-power (100 W) operation is envisioned, RG-58C/U is employed as feedline. The antenna conductors are attached by drilling holes through the PVC tee, and looping the antenna conductor through the hole, before soldering. No matching transformer or balun was used, as impedance of the feedline (52 ohms) was close enough to the anticipated feedpoint impedance.

The drooping ends of the radials are secured to the PVC tees at the end of the horizontal supports with electrical tape. The length of each side was cut to approximately 14-1/2 feet, with the remainder of electrical length (approximately 16-1/2 feet total, depending upon desired frequency of operation) to be made up by the adjustable VSWR elements mounted on the ends of the antenna. The elements droop at about 34 degrees, for no particular reason other than the space available.

Adjustable VSWR elements

In order to adjust the electrical length of the antenna, adjustable elements were improvised from rabbit ears salvaged from an old TV set. One of the sliding elements was mounted at each end of the horizontal support, and the antenna conductor was soldered to this element.

A short section of wooden dowel was driven into the top end of each of the PVC tees mounted at the ends of the horizontal support. A vertical hole (to fit) was drilled through each dowel, and the rabbit ear element was pushed through the hole and glued into place. The antenna conductor was then soldered to the bottom end of the element, allowing easy adjustment of antenna electrical length (VSWR), without having to drop the entire antenna assembly.

Must be magic

Hams who have used this antenna claim it outperforms a conventional

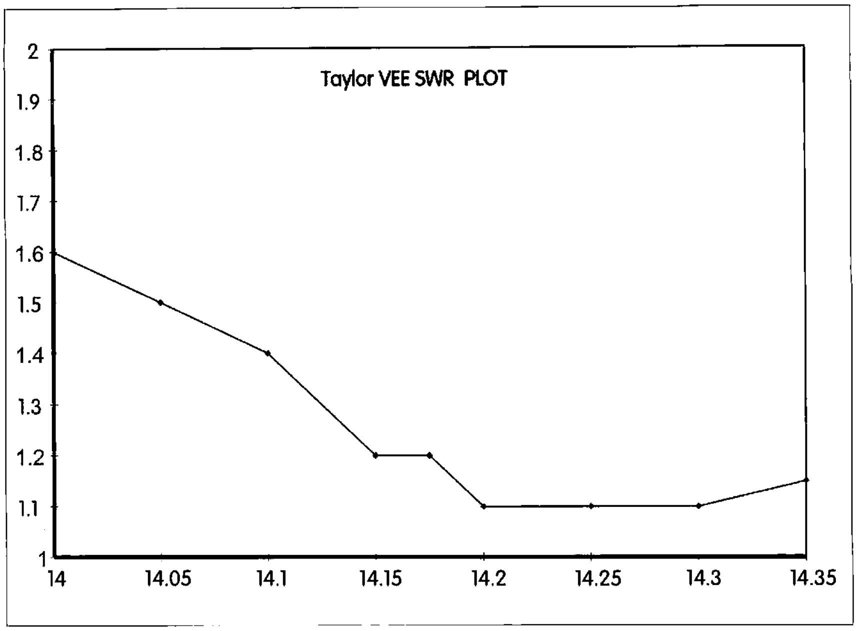


Fig. 2. Taylor Vee SWR plot.

dipole, under similar conditions. In an effort to better understand this apparent performance improvement, some rudimentary testing was done of both VSWR and radiation pattern.

VSWR was measured across the entire 20-meter band, and proved to be usably low across the entire band, with near-perfect match in the phone portion of the band. Due to the adjustable elements, this was easy to shift in frequency. The wide VSWR bandwidth was a pleasant surprise. No VSWR testing was done outside the 20-meter band limits. See **Fig. 2.**

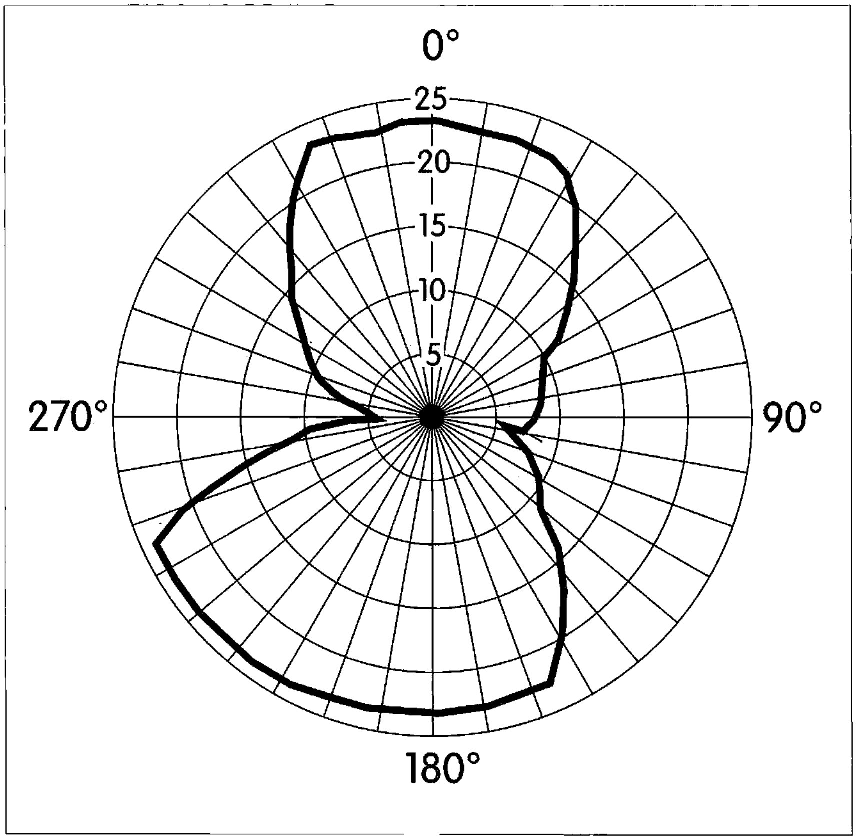


Fig. 3. Taylor Vee azimuth pattern. Units are relative field strength in dB. Antenna plane lies on 270-90 degree line.

A simplistic measurement of a single point received signal was made, to roughly determine the radiation pattern of the antenna. An IFR-500 service monitor was used as a signal source, and the station transceiver, a Kenwood TS-440, was used in receive mode to measure strength of received signal vs. antenna orientation. Signal strength was adjusted to give nominal mid-scale S-meter readings. S-meter readings were recorded vs. antenna position, and plotted to represent antenna pattern.

Because of the design of the antenna, with drooping radials, and vertical VSWR adjustment stubs at the ends of each element, it was decided that any assessment of correct polarization would be a wild guess, so we opted to use a transmit antenna (IFR-500) aimed at about 45 degrees above the horizon as a "best guess" compromise.

Antenna boresite was determined, using the MK1 Mod 0 eyeball, by setting the antenna element perpendicular to the line to the IFR-500. The signal source was located several hundred feet away, to avoid near-field effects.

The antenna was rotated in approximately 15-degree steps around the signal source direction, and S-meter readings were recorded at each step. The azimuth indicator on the rotator was used for direction readings, which were quite coarse.

S-meter readings were converted to dB, relative to boresite amplitude, and recorded vs. direction. No calibration of the receiver S-meter was done, and we assumed 6 dB per S-unit. After recording, these readings were input to a C++ program, part of a radar antenna modeling software package developed by WA5NPQ for Wright Labs, and expanded to 4096 points. The points entered were extrapolated by software, by using the current point measured, the last point measured, and the next point measured, and applying a curve-determining algorithm to determine the approximate value of the intermediate points.

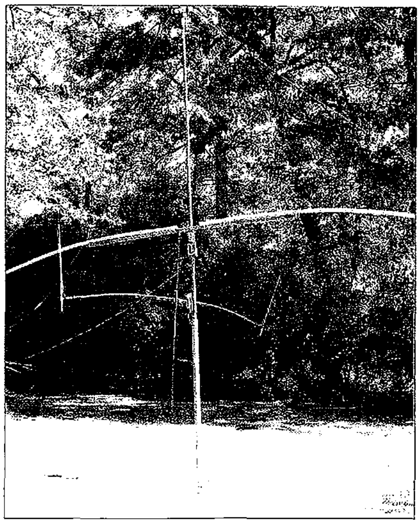


Photo A. "If it ain't broke, don't fix it."

The resulting data was imported into Microsoft Excel®, and plotted as a circular (radar) plot (**Fig. 3**). The resulting plot essentially follows the classic expected dipole characteristics. There are some discontinuities, due to the rough measurement techniques. In addition, some distortion is present, and can probably be attributed to current unbalance in the feed (no balun used), to errors in boresite angle determination (MK1 eyeball calibration), and to errors in angle measurement (Radio Shack azimuth indicator).

Getting there for less

Using ingenuity and a minimum outlay of bucks, the designer ended up with an antenna which fits his available space, is easily adjustable for VSWR, and can be rotated, so no nulls are present. Using only the TS-440 barefoot, he is able to hold his own in the DX quest. He has been able to work as far as Australia and the Cape Verde Islands fairly consistently, working VK6ACY and others on multiple occasions, with very favorable signal reports. Medium and short skip has also been consistent, with excellent results. Why does it work so well? We're still not sure. An entire afternoon of measurement did nothing to improve our understanding. However, we're sticking to two widely accepted engineering maxims: "If it ain't broke, don't fix it!" and "Anything you don't understand must be magic!" 73

NEVER SAY DIE
continued from page 5

Only about 22% of all amateurs are ARRL members, with the trend being toward us old-timers over 50.

The ARRL Board of Directors is loaded down with old-timers like NM7N (71), W4RH (73), WA6WZO (60), and W9PRN (85). Other officers are NØBCI (89), KØTO (66), W6CF (65), and N4MM (61), so perhaps it's no wonder that the League seems to be almost totally out of touch with the bulk of today's hams.

Looking at the results of the last board meeting, I notice that a proposal to increase HF privileges for Novice and Tech-Plus licensees was quickly voted down. Figures. They also rejected a proposal even to study the feasibility of reducing the number of license classes. I've been proposing for years that we have one class of license.

Fellow League members, do you recall ever being asked your opinion on these matters? I know I never have been.

The board decided to push the FCC to better enforce our rules so we won't have to listen to so much bad language on the HF bands. And that, of course, means that the League is going to pressure the FCC to allocate more money to policing our bands — something which I feel we should be doing ourselves. One of the things we've often bragged about is being self-policing. So here we have a government bureau which has been cutting back and auctioning off parts of the spectrum and we're demanding that they spend more money on us because we are unable to keep control of ourselves. Could this demand for more services prompt the commissioners to question the relevance of amateur radio in today's world?

I didn't see anything in the board meeting report about the ARRL initiating any efforts to clean up the mess some of our older hams are making of our HF bands. Every time I bring this up I get accused of League bashing. Well, as a member, I feel it is the responsibility of my organization to help keep our bands clean. The League should also be making a maximum effort to attract new hams. Instead, I get the overwhelming impression that the powers that be at the League are more intent on keeping QRM down by limiting, as much as possible, the number of hams on HF.

The board agreed to push the FCC to establish the League band plans as part of their official regulations. Talk about a power grab! Leaping lizards! Do you agree with this social engineering move?

Heck, our present band plans don't reflect our current use of the bands. We have wide open and virtually unused CW bands, which fewer than 10% of us who are active are using with any regularity, and crowded phone bands for the other 90%. Considering the channel space required for CW vs. phone, the plans are all the more inequitable.

Somehow I'm reminded of the National Computer Conference, which put on computer shows every year. The shows had hundreds of exhibitors and drew over 100,000 attendees. But they, like the rest of the mainframe and minicomputer industry, ignored microcomputers. Today most of the mainframe companies are out of business and the minicomputer companies about gone, too. I loved it when Compaq bought what's left of DEC. What has happened to Prime, Data General, Wang and the rest? The National Computer Conference blew away with the rest of the old computer industry.

Even the largest of organizations has to stay relevant or they're soon history. Will there be an ARRL in ten years? Will I be getting my 70-year pin? I expect to be around, but I'll be surprised if the ARRL is — unless they start wising up and making themselves relevant to the majority of the hams. Right now, at least 78% of the hams don't think the ARRL is relevant. If we count in the members who agree that some big changes need to be made, we might be pushing 90%. No wonder the directors aren't asking us our opinions and then reflecting them at their meetings.

FCC vs. the Constitution

The requirement in Article I of the Constitution that Congress make all laws has been ignored ever since FDR grabbed the reins 66 years ago. We've gradually gotten used to government agencies enacting legislation, and our blessed liberal courts have put up little resistance. If you go into court today and cite the Constitution to support your case, you'll get laughed out of court. Judges are making laws. Government agencies are making laws, and little of this is benefiting us.

Congress has remained silent while federal judges have usurped their power to levy taxes. Congress has remained silent because you have remained silent.

The latest power grab has been by the FCC. Yep, our semi-beloved benefactor has stuck its hand into the public pocket with a tax on telephone companies to finance Internet services for public schools and libraries. This tax will, of course, be passed along to you with higher charges. The phone companies wanted to at least

Continued on page 81

Penny Pincher's Digital Ammeter

Inexpensive, accurate, seaworthy.

Sam Ulbing N4UAU
5200 NW 43rd Street
Suite 102-177
Gainesville FL 32606

Because I do a lot of mobile ham operating, battery usage is very important to me. During the past few years, when cruising on my boat I have often found my battery voltage becoming lower than it should be. As a consequence, I have been told by the Waterway Radio and Cruising Club net controller that I was "FMing, check your batteries." (The Waterway Radio and Cruising Club meets daily at 0745 Eastern time for about an hour and is dedicated to helping and passing traffic for marine mobile amateurs primarily along the east coast of the US and in the Bahamas.)

To monitor my power use, I decided I needed a good ammeter. I wanted to monitor currents up to 100 amps but also to be able to tell the difference between currents in the 100-milliamp range. Obviously, for this accuracy and precision I would need a digital readout.

Unfortunately, the ammeters at the store were expensive ($65 or more). Worse, the readout was a vague analog device that would only tell me if I was using a lot or a little current. When I looked for digital ammeters, I found I would almost need to mortgage the boat if I wanted one! So I decided to build my own.

Generally, to measure large currents you use a low-resistance shunt and measure the voltage drop across it (**Fig. 1**). (For proper operation, the shunt resistance must be considerably less than the load resistance.) I found that shunts were also expensive, so I decided to build that as well.

The resulting ammeter has worked very well for me and I now know why I am running down my batteries. I talk on the ham rig too much! I solved my discharge problem by using

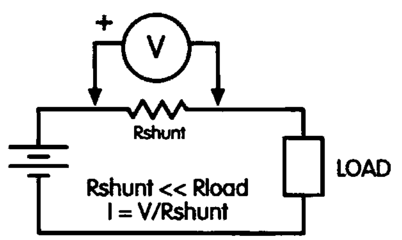


***Fig. 1.** Using a shunt to measure current.*

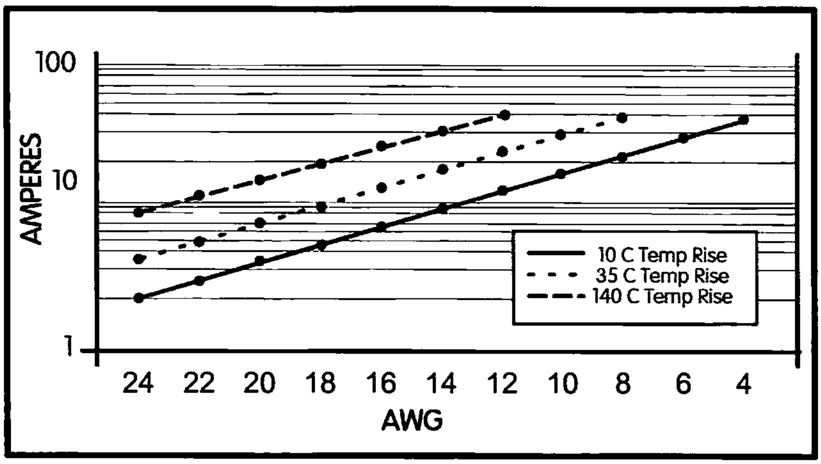


***Fig. 2.** Current-carrying capacity of wire.*

the money I saved through "home-brew" to help buy a bigger alternator.

An inexpensive voltmeter

Excellent and inexpensive digital voltmeters are readily available at many surplus outlets [such as All Electronics, P.O. Box 567, Van Nuys CA 91408; (800) 826-5432]. These 3-1/2 digit meters sell for around $10 and run on 9 V. They come with nice faceplates, making it easy and neat to mount them. The meter consists of an A/D converter chip with built-in display driver (like the ICL7106), an LCD 3-1/2 digit display, and all the parts needed to make it work. A few years ago, before these surplus items came on the market, I had built one of these DVMs from scratch. Just for the parts, I spent twice what the complete meter now costs!

The meter, which uses only about three milliamps, comes with instructions for setting the maximum voltage range that you want to measure. A simple voltage divider will let you set maximum ranges of 2.000, 20.00 or 200.0 volts. If you do not add any resistors, the maximum range is 200.0 millivolts. This is the range that I used for my ammeter. (I also have one set for 20.00 volts max that I use to measure my battery voltage—but that's a different story.) Being able to use the meter without external resistors provides an accuracy advantage, since even 1% resistors have some error—but with no resistors, you get no voltage divider error!

AWG	Ω per 1000 feet
0	.098
1	.124
2	.156
3	.197
4	.248
5	.313
6	.395
7	.498
8	.628
9	.792
10	.999
11	1.26
12	1.59
13	2.00

Table 1. Wire resistances.

These meters come with a built-in disadvantage that fortunately happens to be an advantage for this application. Due to the configuration of the meter circuit, the voltage source used to power the meter must be totally separate from the circuit you are measuring. This means I could not use the ship's 12 V system and a 9 V regulator to power it; I had to use a separate 9 V battery source. There are several ways to do this and each has advantages and disadvantages (see below). The good news is that, because the meter is on a floating power source, it has no problem measuring voltages above the maximum battery voltage—which it might if it were powered from the ship's power supply.

Making the shunt

You are probably saying, "Big deal—you use an off-the-shelf meter to measure a voltage and call it a project." But, of course, there is more. Having bought the digital voltmeter, I tried to locate a current shunt. I wanted to have 100.0 millivolts for 100.0 amps, which would let me read the current directly. A one-milliohm shunt would do the job, but I could not find a proper one

Continued on page 34

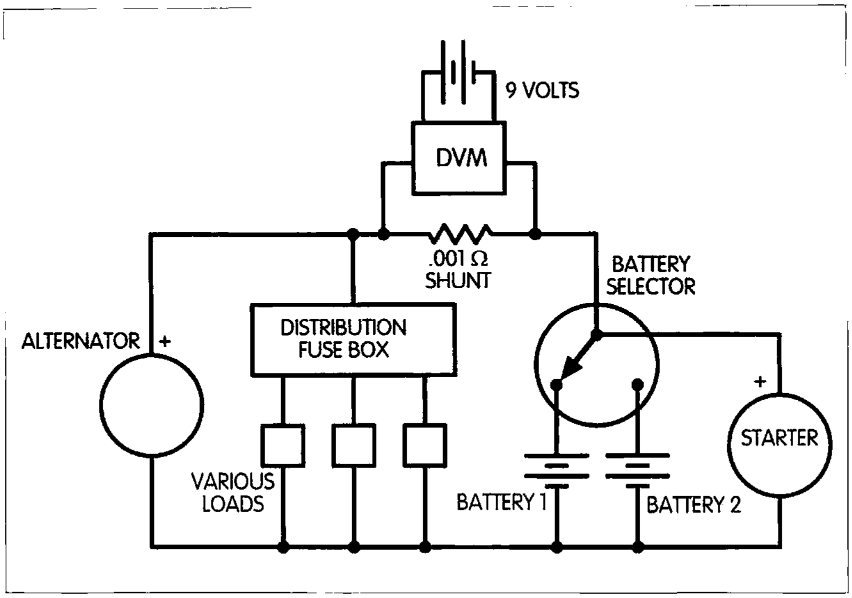


Fig. 3. *Connecting the ammeter to a "real-world" circuit.*

Penny Pincher's Digital Ammeter
continued from page 33

and the shunts I did find were $25 or more.

Fortunately, like many hams I am a pack rat. I recalled a chart I had received from a wire company a few years earlier. Believe it or not, I was actually able to find that chart, and on it was everything I would have ever wanted to know about wires (and even more!). One table gave wire resistance (**Table 1**), and I saw that 1000 feet of #10 wire had a one-ohm resistance (actually 0.9988)—so I could use one foot of it to get one milliohm.

But **Fig. 2** told me that I did not want to do that, since only 45 amps would raise the #10 wire temperature by 140° C (285° F.). By using these two tables, I decided that four feet of #4 gauge wire would work and not get too hot. This size wire is readily available at auto stores, Home Depot™, etc., and implementation was easy.

I coiled up the #4 wire to keep it compact, and soldered a small gauge wire (#18) from each end of the shunt to the voltmeter. I connected the shunt into my ship's power circuit as shown in **Fig. 3**. This circuit allowed me to measure alternator charging current (which is displayed as a positive voltage) and the current used by my radio, lights, etc., as a negative voltage. I chose not to put the starter motor in the circuit because, with its very large current draw, I would have had to use a lower resistance shunt and I would lose my resolution at the lower current levels. This basic design worked well but I was able to improve it further.

Trimming the shunt

Table 1 said the shunt would be one milliohm (a recent *QST* article—November 1997—gave slightly different values), but I suspected that not all wires are created equal and wanted to trim the shunt to be as close as possible to one milliohm. Unfortunately, my expensive ohmmeter does not go down to one milliohm. However, the $10 DVM I was using for the project has a voltage scale that is 200.0 mV full scale, so I could use a part of this project to align the rest of it (neat)! I also had some 0.47 ohm, 5 W, 10% resistors from Radio Shack™ and a 12-volt battery capable of delivering a lot of current with no significant voltage drop. With a battery voltage of 12.55 volts and three of the 0.47-ohm resistors in series as a load, there would be 8.9 amps through the shunt. I trimmed the shunt until it read 8.9 millivolts. It was important to do the measurements quickly because the power dissipation in the 0.47 ohm resistors was 35 watts, not five watts. Of course, the results would have been more accurate if I had used 5%, or better yet 1%, resistors.

[Note: The load resistance (Rload) for my measurement was 3 x .47 = 1410 milliohms and the shunt I was trimming was only one milliohm, so Rshunt << Rload. Other measurement errors include the meter accuracy of 0.5% ± one digit. Except for the 10% uncertainty of the load resistors, I could trim my shunt to about 2% accuracy. I have found that for larger currents I can get better readings using a known low value resistor and voltmeter than from using the ammeter feature of my DVM. This is because the ammeter often has a resistance that is fairly large compared to the load resistance. Further, the exact resistance of the meter is usually unknown, so it cannot be compensated for. For instance, when I placed the three 0.47-ohm resistors across the 12.55-volt source in line with my ammeter on the 20-amp scale, I read 7.05 amps instead of the calculated 8.9 amps. Using another voltmeter, I found that the voltage drop across the ammeter was 2.4 volts. While the documentation states that the "maximum voltage burden" of the meter is 900 millivolts, obviously all the connections increased the voltage drop through the measuring circuit. The uncorrected error using the ammeter would have been 20%, twice the error from using 10% resistors. So, basic as it is, this method can give good results.]

Powering the meter

A 9 V battery: The easiest way to power the meter is with a nine-volt battery. This method did not appeal to me, as I was afraid I would turn the meter on and forget to turn it off, quickly running down the battery.

Four NiCds: Rechargeable NiCd batteries seemed like a better power source, but nine-volt NiCds are scarce and expensive. If I used AA batteries to get nine volts, I would need eight cells: many batteries, much space and expensive. By building the circuit shown in **Fig. 4**, I was able to get nine volts from only four NiCds. U1 is a voltage inverter chip which produces

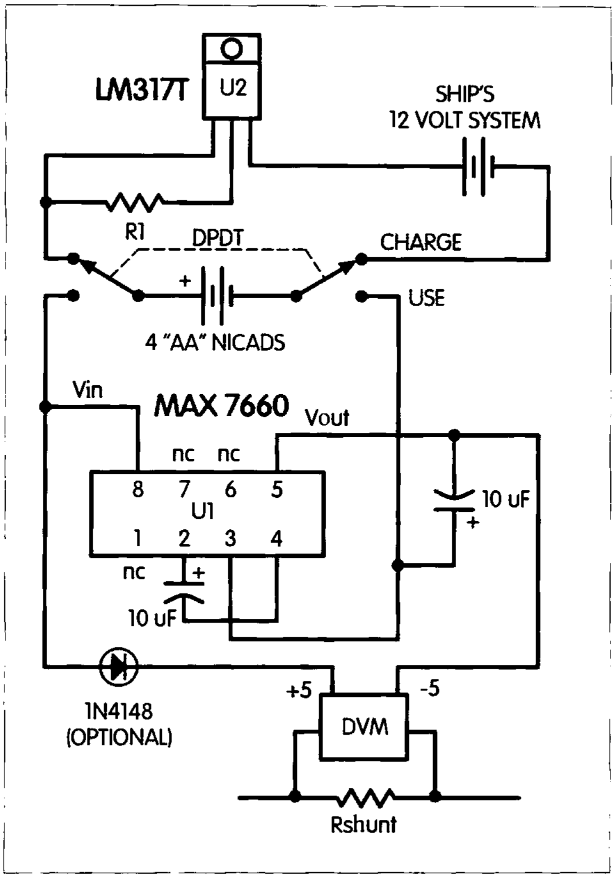


Fig. 4. Powering the 9 V DVM with four NiCds. I_{chg} = 1.25/R1 amps. For I = 40 mA, R1 = ~30 ohms, 1/4 watt.

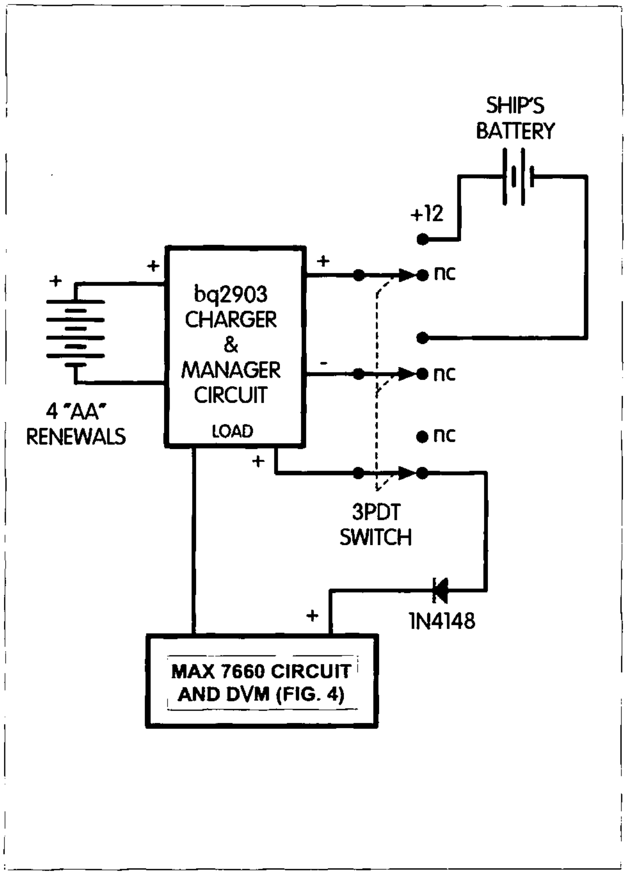


Fig. 5. Powering the DVM with rechargeable alkaline batteries, using a 3PDT switch.

an output voltage that is the negative of the input voltage: five volts positive in (from the four NiCds), minus five volts out. Put a diode in to protect the meter and you have nine volts between the positive and negative voltages. Actually, you do not need a diode at all, as the meter is designed to operate at up to 12 volts (absolute maximum).

Because I planned to mount the meter permanently in the boat, I needed to be able to recharge the batteries in place. This I could do with the ship's power. A simple current source and a DPDT switch did the job. When the meter is off, it is being charged. When it is on, it works from a floating source. Notice that I use a double-pole switch because when the meter is being used, the ground circuit for it must be separate from the ship's ground. The meter worked well all summer, it was accurate and, although I had feared that alternator noise might give strange readings, I found this was not the case.

Despite the fact that it worked well, I had a number of concerns with this arrangement. First, if I forgot and left the meter *on* for a long period of time, I could drain the NiCds and get cell reversal. Second, if I left the meter *off* for a long period of time, I could overcharge the NiCds. I could prevent overcharging by setting the charge current very low, but then it would take a long time to recharge the batteries if I let them run down. Finally, since I would generally only have the meter turned on for short periods of time and then put it back in the charge mode, I would be charging the batteries in a short cycle mode which promotes "memory" effect and eventual capacity loss. These concerns bothered me all summer. I thought about it and suddenly realized I had recently done a project that was custom made for use with this meter.

Four rechargeable alkaline batteries: In my project "Are You Ready to Recharge?" (*73*, March 1997, p. 40), I discussed the characteristics of rechargeable alkaline batteries and presented a circuit that both charged them and monitored their use to prevent excessive discharge. You may recall that the advantages of rechargeable alkalines are:

They are less expensive than NiCds.

They have a much longer shelf life.

They prefer to be recharged often and do not have "memory."

They work best with low current draws.

The disadvantage of rechargeable alkalines is that they will lose a lot of their potential capacity if they are allowed to run down too far. My project made use of a bq2903 chip that monitored battery status to prevent this problem. In addition, it controlled the charging of these batteries to permit a maximum charge rate and yet still prevent overcharge. (Rechargeable alkalines cannot be charged in a constant cur-

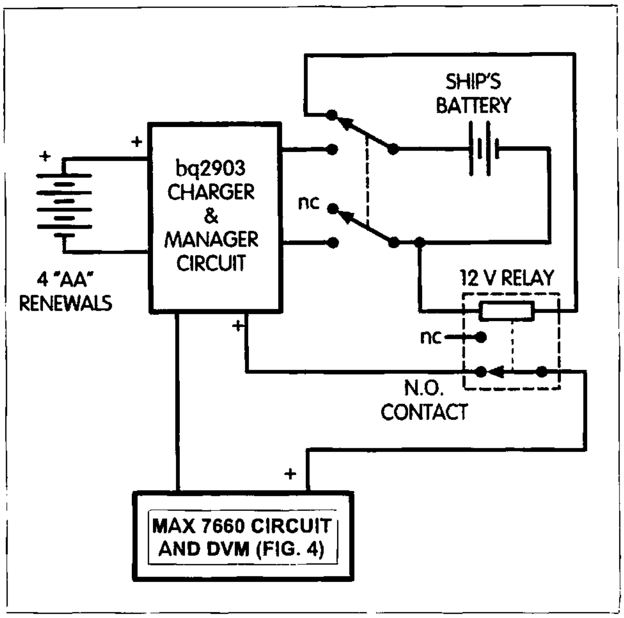


Fig. 6. Using a relay and DPDT switch.

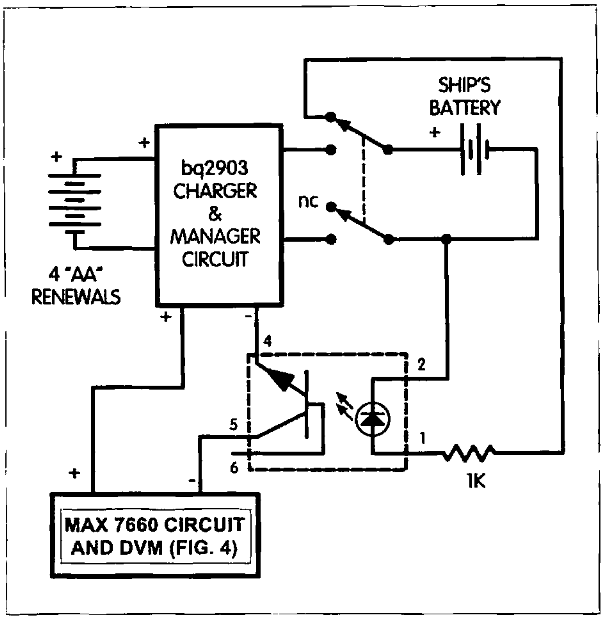


Fig. 7. Using an optoisolator and DPDT switch.

rent fashion as NiCds are. To do so can cause rapid deterioration of their capacity.)

It was apparent to me that here was a perfect application for this project: The meter circuit uses only a few milliamps and I do recharge often. The bq2903 prevents overdischarge if I leave the meter on too long; there is no chance of overcharging, as the bq2903 ends the charging cycle when the batteries are charged. If I leave the meter unused for months, the batteries will still be ready to go. If I let the batteries discharge deeply, the bq2903 circuit will recharge them in only a few hours.

The circuit for this is a little more complicated than the NiCd circuit, but I had a PC board and parts from that earlier project, which made it easy to build, and the advantages made it worth the extra space. **Fig. 5** shows my circuit. When using rechargeable alkaline batteries, it is a good idea to include a diode since these batteries have a higher voltage than NiCds and four of them could cause the voltage to exceed the maximum allowable for the meter.

Because the bq2903 circuit was part of the monitoring circuit and needed to be in line all the time, it was not possible to use a simple DPDT switch as for NiCds. Three wires had to be disconnected and connected to change from "use" mode to "charge" mode. I tried three ways to do this and each worked well.

One way used a three-pole double-throw switch as shown in **Fig. 5**. This is the easiest way if you have such a switch around. If you do not, a DPDT switch and relay will work as shown in **Fig. 6**. Either a normally open (NO) or normally closed (NC) relay contact will do, depending upon how you want the circuit to work. With NC, the meter will run with no external 12 V source (charging circuit). This would work well for a circuit you want to make portable and plug into the 12 V charging source. For the boat, where my meter would be permanently mounted, I felt that a NO relay would offer the advantage that if I disconnected the ship's batteries (which I do when I store the boat), the meter would be turned off and would not run down the alkaline battery.

A third alternative would be an optoisolator (**Fig. 7**). Note that it is used in the negative lead rather than the positive. Note that it too is an NO switch, so without the ship's battery, the circuit is off. With optoisolators at about 50 cents, this seemed an inexpensive and elegant way to go.

With the number of hams who do mobile work these days, I hope the information about these circuits I built will be useful to others. The inexpensive panel meters are a real deal as long as you have a floating power source.

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the August issue, we should receive it by May 31. Provide a clear, concise summary of the essential details about your Special Event.

MAY 2

CADILLAC, MI The Wexaukee ARC will hold their annual hamfest 8 a.m.–1 p.m. at the Cadillac Middle School in Cadillac MI. VE exams for all classes at 1 p.m. Admission S5; 8 ft. table $6. Setup at 6 a.m., table holders only. Talk-in on 146.98 rptr. Contact *Dan KE8KU, Wexaukee ARC, P.O. Box 163, Cadillac MI 49601. Tel. (616) 775-0998; E-mail [ke8kudan@juno.com].*

COLORADO SPRINGS, CO The Pikes Peak Radio Amateur Assn. Swapfest (amateur radio and computer) will be held at Doherty High School, 4515 Barnes Rd., 8 a.m.–2 p.m., with setup at 6 a.m., and VE exams at 10 a.m. Adm. $4, under 18 free. Tables, S12 for the first, S10 each for additional tables. Talk-in on 146.970 (100 Hz CTCSS) or 146.520. Contact *Phil Pearsall KC5LXC, (719) 531-5319; or E-mail [pearsall@msn.com].*

MAY 2–3

ABILENE, TX The Key City ARC will sponsor a hamfest at the Abilene Civic Center from 8 a.m.–5 p.m. Sat., and 9 a.m.–2 p.m. Sun. Free parking. VE exams. Wheelchair access. Tables $6 each. Pre-registration S7 (must be received by Apr. 28th). S8 at the door. Talk-in on 146.160/.760. For reservations and info, contact *Peg Richard KA4UPA, 1442 Lakeside Dr., Abilene TX 79602. Tel. (915) 672-8889.*

MAY 3

YONKERS, NY The Metro 70 cm Network will hold another Giant Electronic Flea Market at Lincoln High School, Kneeland Ave., Yonkers NY, 9 a.m.–3 p.m., rain or shine. Free parking. No tailgating. Indoor flea market only. VE exams. Vendors: $19 first table, $15 each add'l table. All tables 30" x 5', or bring your own tables at S14 for a 6 ft. space. At the door S25 each table, S20 for a 6 ft. space. Full payment is due with registration. Mail reservation payments to *Metro 70 cm Network, 53 Hayward St., Yonkers NY 10704.* Spaces will not be held past 9 a.m. No refunds unless prior notice of cancellation has been received 72 hrs in advance. Donation S6, kids under 12 free. Table setups at 7 a.m. Free coffee, door prizes, grand prize drawing at 1:00 p.m. For registration, or vendors' or buyers' information, call *Otto Supliski WB2SLQ, (914) 969-1053.* Talk-in on 449.425 MHz PL 156.7; 223.760 MHz PL 67.0; 146.910 MHz; and 443.350 MHz PL 156.7.

MAY 9

GOSHEN, NY The Orange County ARC will present their Spring Hamfest, 8 a.m–2 p.m. at John S. Burke Catholic High School, Fletcher St. (exit 122A on Route 17) in Goshen. Admission is S5 for buyers; spouses and kids free. Tailgating $6, weather permitting. Indoor tables supplied for $10 each; $7 per space for your own table. Free parking. VE Exams. New and used rigs. SKYWARN training. ARES/RACES introduction to emergency service. For info and reservations, contact *Edward J. Moskowitz N2XJI, 123 Harold Ave., Cornwall NY 12518, (914) 534-3492.*

MANITOWOC, WI The Lakeshore Hamfest, Electronics & Computer Swapfest will open its doors at 8 a.m. at the Manitowoc County Expo Center, intersection of Hwys 42–151 and I-43 on County Hwy. Rd. Fri. night setup for vendors until 10 p.m.; also starting at 6 a.m. Sat. morning. Accommodations for vendor drive-ins. Advance tickets S3, $4 at the door. Reserved 8 ft. tables $6 each. Electric outlets $5 each. VE exams for all classes at Silver Lake College (Hwy. 151); test registration closes at 9 a.m. DXCC field checking at the expo. For info call *Glenn, (920) 684-7096, any time,* or *Red, (920) 684-9097, days.* Talk-in on 146.61(-) or 147.03(+). Send reservation payments with an SASE to *Mancorad Radio Club, P.O. Box 204, Manitowoc WI 54221-0204.*

MAY 14–17

DAYTON, OH The QRP Amateur Radio Club International will present their "Four Days in May" 1998 Conference at the 1998 Dayton hamvention®. Amateur radio QRP presentations, workshops, and demonstrations will be the focus of the all-day Thursday QRP Symposium to be held at QRP ARCI headquarters, the Days Inn Dayton South. Registration is S10 if prepaid by May 1st and $12 after that or at the door. "At the door" registration may be limited by sellout. Registration will cover a full day of QRP Symposium activities, coffee, Symposium bag stuffers and a complimentary copy of the FDIM 98 QRP Symposium Proceedings. Make payment to QRP ARCI, and send with an SASE by May 1st to *Cam Bailey KT3A, FDIM Symposium Registration, P.O. Box 173, Mt. Wolf PA 17347.* E-mail queries to *[kt3a@juno.com].* The QRP-ARCI Awards Banquet, Fri. May 15th, is being hosted by FDIM Banquet Chairperson Scott Rosenfeld NF3I. Please send an SASE and your $22 banquet ticket fee (US check, money order, international money order) made payable to QRP ARCI (by May 1st) to *Scott Rosenfeld NF3I, QRP ARCI Banquet Tickets, 4015 Sparrow House Lane, Burtonsville MD 20866-1333.* E-mail queries for more info to *[ham@w3eax.umd.edu].* The FDIM QRP Vendor Social will be held Fri. evening May 15th, with Jim Stafford W4QO, QRP ARCI VP, as the host. For registration info please contact *Jim at 11395 West Rd., Roswell GA 30075, or E-mail [w4qo@amsat.org].* The Days Inn Dayton South will be the 1998 FDIM QRP headquarters and a special block of rooms has been secured. Please contact *Hank Kohl K8DD, 1640 Henry St., Port Huron MI 48060; E-mail [k8dd@tir.com]* regarding availability of rooms. QRP Symposium presenters, please submit your QRP technical manuscripts to *FDIM 98 Technical Paper Chairperson Ken Evans W4DU, 848 Valbrook Court, Lilburn GA 30047; or E-mail [w4du@bellsouth.net].*

MAY 15

DAYTON, OH The Southwest Ohio Chapter of the Quarter Century Wireless Assn. will hold its 1998 Annual Banquet in conjunction with the Dayton Hamvention, at Alex's Continental Restaurant (off State Route 725, 1/2 mi. west of I-75). COD bar at 7 p.m., banquet at 7:30 p.m. After-dinner speaker will be Tom Cecil, Attorney (Ret) and author of *I Want My Turn In The Shower.* Reservation deadline is May 13th. QCWA membership is not a requirement for attendance. Reservations are S15 each. Make check payable to *Robert L. Dingle, Treas. Chapter 9* and mail to: *1117 Big Hill Rd., Kettering OH 45420-1201.*

MAY 16

WILLMAR, MN The Willmar Hamfest Committee will hold their 1st Annual Hamfest and Electronics Swapmeet at the Senior High School Cafeteria, 9 a.m.–2 p.m. Advance tickets $4 each, $5 at the door. Flea market space S5 per space/table; commercial vendors $10 (1'–8' table or 1 parking space). Make checks payable to Willmar E.A.R. and mail with SASE to Hamfest '98, 209 Hawaii St. NE, Willmar MN 56201. Reservation deadline is May 15th. VE exams begin at 8 a.m. sharp; doors open at 7:30 a.m. Pre-registration required; payment at the door. Walk-ins accepted only if space is available. Mail your name, call, city, state, ZIP, and which exams you wish to take to *Willmar Hamfest Committee, 209 Hawaii St. NE, Willmar MN 56201.* Talk-in on 146.91(-).

MAY 17

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society and the Harvard Wireless Club will co-host a tailgate electronics, computer

and amateur radio Flea Market, 9 a.m.–2 p.m. at Albany and Main St. in Cambridge. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance; includes one admission. Setup at 7 a.m. For space reservations or info, call (617) 253-3776. Mail advance reservations before May 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725 PL 2A W1XM rptr. Rain or shine.

MAY 22–23

PASCAGOULA, MS The Jackson County ARC will hold its 4th annual Hamfest in the Pascagoula MS Civic Center, located on the Jackson County Fairground. This is an ARRL-sanctioned event. Talk-in will be on the W5WA rptr., 145.110(-), alternate 146.880(-). Hours are 1700–2100 May 22nd, and 0800-1500 May 23rd. Admission is $2.50 for 12 and over; under 12 admitted free. Bring a copy of your license to be eligible to win a transmitter. Table rental is $8 per 8' table. RV parking available on site. Nearby hotels and motels at reasonable rates. VE exams will be available Saturday at 1200 hours. Bring your original license or CSCE plus a copy, a picture ID, and $6.35. The Novice test is free. Contact *Charles F. "Kim" Kimmerly N5XGI, Hamfest Chairman, 19000 Busby Rd., Vancleave MS 39565. Tel. (228) 826-5811.*

MAY 23

DURHAM, NC The 24th annual Dur-Ham-Fest will be held at South Square Mall, 8 a.m.–3 p.m. Tickets $4 in advance, $5 at the gate. Send SASE and payment before May 10th. Tables $10 in advance, $12 at the gate as long as they last. Tailgaters $5 per space plus admission. Info, tickets and reservations contact is *Rodney Draughon AE4JW, 794 Harris Mill Rd., Rougemont NC 27572. Tel. (336) 364-7420; E-mail [ae4jw@juno.com].* VE exams 10 a.m.–1 p.m., pre-registration requested. Walk-ins welcome. Contact *David Snyder, N2MLU, 4505 Governor Hunt St., Efland NC 27243; (919) 644-8681.*

MAY 24

CHICAGO, IL Chicago ARC will hold their annual Hamfest at DeVry Institute of Technology, 3300 N. Campbell, 8 a.m.–3 p.m.; setup at 6 a.m. Tickets $4 in advance, $5 at the gate. Indoor tables $1.50/ft. Outdoor swapfest space and parking free. Talk-in at 147.255(+). For info and reservations write to CARC, P.O. Box 410535, Chicago IL 60641-0535; or write to *CARC, 5631 W. Irving Pk. Rd., Chicago IL 60634;* or call *George (773) 545-3622; or Dean (708) 331-7764.*

MAY 30

LOVELAND, CO The Northern Colorado ARC will sponsor a Superfest Swapmeet 8 a.m.–3 p.m. at Larimer County Fairgrounds, 700 S. Railroad. Free parking, commercial exhibitors. VE exams. Admission $3, tables $8 each; contact *Jeanene Gage NØYHY, (970) 351-7327.* For general info, contact *Michael Robinson N7MR, (970) 282-1167.* Talk-in on 145.115(- 100) and 146.52.

MAY 31

FAIR OAKS, CA The North Hills Radio Club (of Sacramento) will hold its annual Swapmeet 6 a.m.–12 p.m. Sunday, May 31st, at the Bella Vista High School, 8301 Madison Ave. in Fair Oaks. From I-80, take Madison Ave. east for 5.8 mi. to H.S. From Hwy 50 take Hazel Ave. north 1.5 mi. to Madison Ave., turn left and go west 1 mi. to H.S. Seller spaces $10 (two parking spaces), buyers enter free. New, used and surplus amateur radio gear, electronic test equip., and amateur-related computer gear. Contact *Bob Maylor AC6HF, (916) 966-3654; E-mail [ac6hf@juno.com].*

JUNE 6

TEANECK, NJ The Bergen ARA will hold its annual Fall Hamfest at Fairleigh Dickinson Univ. Buyer admission $5 with XYLs and harmonics free. Seller admission $10. VE exams. Take Route 4 east/west to the River Rd. exit. Follow the signs into the hamfest area. Talk-in on 146.790(-600). Contact *Jim Joyce K2ZO at (201) 664-6725 before 10 p.m.*

JUNE 7

BETHEL PARK, PA The 44th Breezeshooters' Hamfest will be held Sunday, June 7th, 8 a.m.–4 p.m. on the Butler Farm Showgrounds, just north of Butler. Handicapped accessible. Admission $5 per person, under 12 admitted free. Take PA Rt. 68 East from Interstate 79, or take US Rt. 68 West from PA Rt. 8. Talk-in on 147.96/.36. Vending tables $15 per table, rented in advance, first come, first served. Reservation deadline is May 15th. Send payment with an SASE to *George Artnak N3FXW, 3350 Appel Rd., Bethel Park PA 15102,* or call the *Breezeshooters' Hotline at (412) 854-5593;* or via E-mail to *[geoart@usa.net].* Check out the Breezeshooters' Web site at *[http://www.users.sgi.net/~wolfie/].*

JUNCTION CITY, WI The Central Wisconsin Radio Amateurs, Ltd. (CWRA), cordially invites your participation at their 21st annual Swapfest and Auction, Sunday, June 7th, at the US Army Reserve Center. This is a new location and offers Saturday evening setup and overnight security, as well as inside-the-building loading and unloading. Tables are $4 each if requested prior to May 15th. After May 15th, tables will be $7 plus admission. Admission tickets will be $3, and free for children under 12. Doors open to the public at 8 a.m. (6:30 a.m. to vendors choosing Sunday morning setup), with shutdown by 1:30 p.m. We are encouraging tailgaters to sell their unsold goods at our auction at noon. Talk-in on 146.670 WB9QFW and 146.985 W9NN repeaters. Contact *John Feltz W9JN, CWRA Swapfest Chairman, 973 East First St., Junction City WI 54443-9614. Tel. (715) 457-2506; E-mail [jfw9jn@tznet.com].*

MEDINA, OH Join the M2M Group for the 1998 Medina County Hamfest, Sunday, June 7th, at the Medina County Fairgrounds Community Center, 735 Lafayette Rd., Medina OH. Vendor setup at 6:30 a.m. Open to the public 8 a.m.–3 p.m. Reservation deadline is May 23rd. Enclose an SASE for return of tickets. Send advance payments to *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258.* Please call *(330) 725-0119* for info about VE exams; walk-ins welcome. Mobile check-in on 147.630/.030.

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds in Princeton IL. Doors open at 6 a.m. Advance tickets are $5 with 4 stubs before May 20th, and $6 with a single stub at the gate. Camping and outdoor flea market area is free. 8' tables indoors are $10 each. Talk-in is on 146.355/.955 PL 103.5. Contact *Bruce Burton KU9A or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Phone (815) 795-2201; E-mail [brburton@mtco.com].*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the NY Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendor setup at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. Buyer's donation $5 , seller's $10 per space. Talk-in on 444.200 rptr., PL 136.5. Contact at night only, *Stephen Greenbaum WB2KDG, (718) 898-5599; or E-mail [WB2KDG@bigfoot.com].*

JUNE 13

FERGUS, ONTARIO, CANADA The 24th Central Ontario Amateur Radio Fleamarket will be held at the Fergus and District Community Center (just a few miles north of Guelph on Hwy. 6), beginning at 8 a.m. Setup at 6 a.m. Snack bar and rest rooms open at 6:30 a.m. General admission $5, under 12 free. Tailgating $5 per space; indoor tables $10 per 8' space. On-site fully serviced campground lots available at $13.75 per night. Talk-in on VE3ZMG at 145.21; VR3KSR at 146.97; or simplex 146.52. Make all checks payable to *Central Ontario Amateur Radio Fleamarket* and mail with SASE to *Bill Smith VE3WHS, 32 McElderry Rd., Guelph Ontario N1G 4K6, Canada. Tel. (519) 821-6642. E-mail [fleamarket@kwarc.org];* or check the Web site at *[www.kwarc.org/fleamarket].*

PADUCAH, KY The Paducah ARA Hamfest will be held Saturday, June 13th at the Executive Inn Convention Center in downtown Paducah, 8 a.m.–3

p.m. VE exams at 1 p.m. Plenty of free parking. Admission $5, tables $6 each, with one free ticket per vendor. Write to *The Paducah Amateur Radio Assn., P.O. Box 1022, Paducah KY 42002-1022; or E-mail [KC4ENA@Apex.Net].*

JUNE 14

ERLANGER, KY The Northern Kentucky ARC, Inc. (of Covington KY), will host their "Ham-O-Rama '98" June 14th, 8 a.m–3 p.m. at the Erlanger Lions' Park. Take I-75 to Exit 184 (Route 236 East). Go one mile and turn right on Dixie Hwy (US Route 25 & 42). Go one mi. to Sunset Avenue, turn right and go to the end of Sunset Ave. For more info or advance registration, contact *Robert Blocher N8JMV c/o NKARC, P.O. Box 1062, Covington KY 41012. Call evenings at (513) 797-7252.* Or call *Neal KC4FET, (606) 341-1213; or Ken KZ5KR, (606) 384-4002.* Indoor exhibit area for major vendors. Extensive outside flea market with setup at 6 a.m. Tickets $4 in advance, $5 at the gate; children under 13 admitted free. Flea market spaces $2 each (bring your own table and chair). Indoor vendor space $15 per table (provided). Registration deadline is June 1st. Send remittance with an SASE. Talk-in on 147.255(+) or 147.375(+) K4CO rptr.

JUNE 21

CROWN POINT, IN The annual "Dad's Day" Hamfest, sponsored by the Lake County ARC (of Merrillville IN) will be on June 21st at the Lake County Fairgrounds in Crown Point. Talk-in on 147.00, 146.52 and 442.075. There will be computers, software, and hardware vendors. Setup begins at 6 a.m. Doors open to the public at 8 a.m. Admission $5 per person, tables $6 each. Contact *Malcolm Lunsford W9MAL, 6721 Harrison Ct., Merrillville IN 46410-3323. Tel. (219) 769-3925; or E-mail [w9mal@cris.com].*

JUL 26

HONOLULU, HI In celebration of their third wedding anniversary, a grand Ham-Boree is being planned by Gordon Crowhurst G4ZPY and Brenda in the form of a big get-together of hams and their partners for an evening meal in Honolulu. They would like to put a face to a callsign, a face to a name, of their many friends and acquaintances all over the world. For those who are interested, there are a lot of nearby mountains for DXing on the Pacific Rim. For more info contact *G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough, Ormskirk, L40 7TG England. Tel./FAX (44) (0)1704-894299* anytime until 2300, but not between the hours of 1600–1830 local time. Everyone must make their own holiday arrangements themselves and pay for their evening meal. Please R.S.V.P. so that a suitable location may be arranged for the get-together.

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

MAY 1–2

BEAVERCREEK, OH Members of the Upper Valley ARC will be assisting nine-, 10- and 11-year-old elementary school children as they hold their special event station commemorating the 4th Anniversary of Parkwood Elementary School's fourth grade class "Adopt-A-Ham Program." Mike Fisher KI8CJ is founder and instructor of the students involved in this program. Each volunteer ham is assigned four or five of Mike's students in the beginning of the school year. On a weekly basis the amateur and children hold a scheduled QSO on UVARC's two-meter repeater. By the end of the school year the children have developed valuable communication skills and the participating amateurs learn a thing or two from the youngsters. The special event station will operate for 24 hours, beginning at 2000 UTC on May 1st, using the call KI8CJ. Frequencies: 145.11, Kettering Medical Center; 146.64, Miami Valley FM Assn.; 146.94 Dayton ARC; 147.135, Far Out ARC, and 145.41, Upper Valley ARC. Special QSL cards will be issued to those confirming contact in writing to *Mike Fisher KI8CJ, Parkwood Elementary Schools, 1791 Wilene Dr., Dayton OH 45432.* An SASE must be included to receive a QSL card. Please submit your QSL request immediately after the event, since school will be out the first of June. Any requests received after June 1st will be held until school begins in the fall.

MAY 1–3

MARTHA'S VINEYARD ISLAND, MA The Fall River ARC, on a mini-DXpedition, will operate W1ACT/P from the historic Gay Head Cliffs and Lighthouse on Martha's Vineyard. Operation may be on or near IOTA net frequencies and with all Extra class privileges, propagation permitting. Please QSL via *Roland Daignault, Jr. N1JOY, 19 Davis Rd., Westport MA 02790. E-mail [roland-d@ici.net].*

MAY 2–3

1998 CONNECTICUT QSO PARTY The Connecticut QSO Party, sponsored by the Candlewood ARA, will operate 2000Z May 2nd–2000Z May 3rd, with a rest period 0400–1200Z. Phone, RTTY and CW. CW—40 kHz up from lower band edges; Novices 25 kHz up from low end; phone—1.860, 3.915, 7.280, 14.280, 21.380 and 28.380. VHF—50.150, 144.200, and 146.580. RTTY—normal RTTY bands. All bands (HF, VHF, UHF) except WARC bands count. For rules and info, please contact *CARA, P.O. Box 3441, Danbury CT 06813-3441 USA.* Remember to enclose an SASE. Send entry and SASE for results by June 3rd.

Continued on page 86

73 Review

Brits Get Gaussian

... with GMSK Data Products' high-speed packet modem.

Roger J. Cooke G3LDI
The Old Nursery, The Drift,
Swardeston, Norwich,
Norfolk NR14 8LQ, UK
[mtaylor@uk.mdis.com]

GMSK Data Products is a partnership company set up by two professional electronic design engineers who are also keen radio amateurs: Matt G6WPJ and John G8STW. They are the sysops of the TCP/IP packet stations GB7WPJ and GB7STW, respectively. Matt and John are also avid members of their local TCP/IP group, the Essex IP Group or EIPG.

Their first project was to design a high-speed modem for use by radio amateurs. They wanted to see if better than 9600 bps was possible in normal 25 kHz channels, as well as to modernize on the excellent design created some years ago by James Miller G3RUH. The result was the Vfast28.8 modem adapter for a TNC2.

This proved very effective, and as a result of an approach from the Essex group and the East Anglian Data Group (EADG), Matt and John decided to develop a real-time bit repeater for speeds of up to 38,400 bps. In fact, they managed 57,600 bps and two further products resulted: the AX384 and the AX576.

These new TNC designs have generated a lot of interest and are now being looked at by a number of packet groups around the UK as the basis for the new high-speed network. The Vfast28.8 modem adapter also developed into a full RS232-driven radio modem for transparent data transfer not using the overhead of AX25: the RSM192. And a smaller, more compact version—the RSM192S—has also been produced as a custom project for a company in the USA.

These well-engineered products use modern design techniques, including the PIC family of microcontrollers for high-speed bit processing. In the RSM192, the PIC micro is used to manage the RS232 comms, handle a complex two-speed fast-frame acquisition sequence, generate a very effective data carrier detector, and provide real-time bit randomizing. The PCBs are of very high quality and the layout is done with good analog-to-digital separation in mind. Quality in design and production is taken very seriously by both Matt and John.

GMSK

A method of data modulation known as Gaussian Minimum Shift Keying (GMSK) is used to pass data as fast as practicable in the radio channel. GMSK modulation and demodulation and the modems' control and data coding can all be performed by the latest integrated circuit devices. This makes for a compact design and layout which is easy to build and provides for high performance.

Features

- Radio port speeds of 4800, 9600, 19200, and 38400 bps with AX384; 7200, 14400, 28800, and 57600 bps with AX576.
- The high-speed radio modem operates full duplex at all the radio speeds above with no component changes.
- RS232 port speeds from 9600 to 38400 bps (AX384) or 115200 bps (AX576).
- TAPR TNC-2 EPROM-compatible, including NET/ROM and 64 K EPROMs such as TheNet X1J and ROSE.
- A real-time bit repeater can be enabled from software; it provides a contention-free LAN in its coverage area. An intelligent FIFO buffer allows transmission of long frames without bit under-/overruns. Other TNC functions are unaffected, allowing simultaneous use, e.g., as a Node—TheNet X1J.
- Setup software in ROM allows modem configuration to be modified on screen.
- Live link-bit error rate measurements enable easy setup of data links.
- Full Morse ID as per UK license regulations, regardless of TNC software fitted. This can be disabled for use elsewhere.

• 96 K ROM space allows (in addition to Setup and KISS ROM) 1 x 32 K EPROM, 1 x 64 K EPROM or 2 x 32 K EPROM images to be fitted.

• 128 K RAM can be fitted in place of the normal 32 K if required.

• Radio control signals PTT and Mute can be set active high or low from setup software.

• 10 MHz Z80 processor ensures no lost or missed frames due to software errors.

• Choice of data randomizer allows G3RUH or GRAPES method to be used.

• Bi-phase data coding can be selected in place of data randomizer to allow simple interfacing to most types of voice radios (includes FM/PM crystalled or synthesized).

• RS485 interface option allows multiple TNCs to be connected in "Node Stack" with simple four-wire cable. No more diode matrices!

Frequency shift keying

The simplest method of sending data signals over an FM radio is to use a frequency shift in one direction to represent a logic 1 and a frequency shift in the other direction to represent a logic 0. For example, a transmitter may operate on a carrier frequency of 144.500 MHz and move its carrier down by 3 kHz to 144.497 to signal a logic 0, and then up 3 kHz to 144.503 MHz to represent a logic 1. Note that no audio subcarrier is used. This is shown in **Fig. 1**.

This method, known as FSK, in fact works well and is used widely at present on the UK network with the usual two meter and 70 cm rigs. However, it has been shown that an efficient form of FSK occurs when the frequency shift (dF) is half the data rate (DR) of transmission. This form of FSK is known as Minimum Shift Keying (MSK). Expressed in mathematical terms, the definition of MSK becomes:

$$dF = DR/2$$

In the example in **Fig. 1**, the total frequency shift is 6 kHz. It can therefore be inferred that if MSK is being used with this deviation, the data rate must be 1200 bps. A further requirement of MSK is that the change from one signaling frequency to the other must be done with a continuous waveform and with no phase discontinuities. Although this may not be true with the Vfast28.8 modem, there is no practical effect on its actual performance.

It is apparent that although the Vfast28.8 modem is described as a (G)MSK modem, this will only be true if the radio peak deviation is set up to be half the data signaling rate, e.g., 7200 Hz for a 14,400 bps transmission speed.

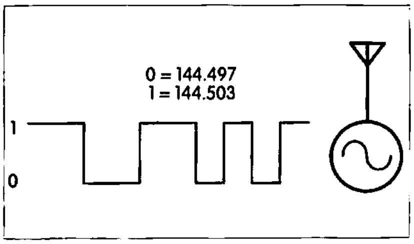


Fig. 1. Using frequency shift keying, an FM radio can transmit in one direction to represent a logic 1 and in the other to represent a logic 0.

Gaussian filters

The main reduction in bandwidth comes from the use of frequency shaping before FM modulation takes place. This is done by taking the square waves of the serial data signal and passing them through a low-pass filter. One type of suitable filter is the Raised Cosine Filter which is used in some radio modem designs.

The Vfast28.8 modem uses a so-called Gaussian filter. A Gaussian low-pass filter is a filter which, when excited by a single impulse at its input, gives a Gaussian-shaped output response. The shape known as a Gaussian curve is also sometimes known as a Normal Distribution curve.

The Gaussian filter provides an excellent shape for radio data applications. If the basic FSK transmitter is modified by the use of MSK and the addition of a Gaussian input filter to give a GMSK system, the resultant bandwidth of the data signal is now much reduced and is suitable for transmission by a narrowband FM radio. This is illustrated in **Fig. 2**.

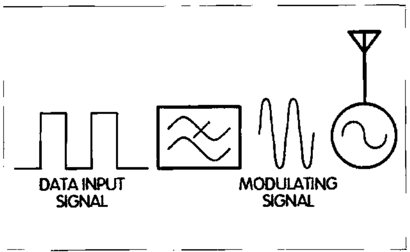


Fig. 2. Resultant bandwidth reduction with the use of a Gaussian filter.

The frequency at which the low-pass Gaussian filter starts to work has a direct influence on the bandwidth used for transmission. The lower the frequency relative to the data rate of the signal, the narrower the transmission spectrum, but the higher the likelihood of bit errors during transmission. The ratio of the -3 dB point of the low-pass filter (F1) to the data rate is known as the BT value. This can be shown by:

BT = F1/DR

The Vfast28.8 design provides the ability to select two BT values (0.5 and 0.3) for each data rate. As a guide, the following figures can be regarded as the maximum data rates which can be achieved in different channel bandwidths using BT values of 0.5 and 0.3. For BT = 0.5, 4800 bps in 12.5 kHz; 9600 in 25.0; 19,200 in 50.0. For BT = 0.3, 8000 bps in 12.5 kHz; 16,000 in 25.0; 32,000 in 50.0.

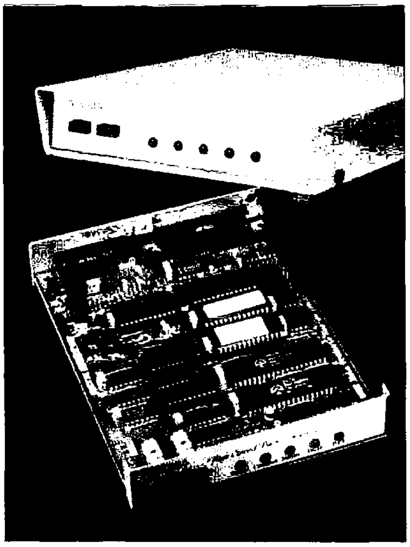


Photo A. *The AX384 is a handsome unit inside and out.*

GMSK as a method of transmission is simple and effective. It does, however, require care with some points. These mainly concern the transmission of long strings of "1"s and "0"s. This is because a string of 1000 logic "1"s will appear as a single frequency shift at the beginning of the string and a further frequency shift at the end of the string.

This can lead to problems with the receiver not being able to track the incoming signal correctly. Both bit timing and lever information can be lost. When a BT value of 0.3 is being used, problems also occur with single bits bounded by their complement being sent repeatedly. For example, the bytes 00010000 or 11111110 sent many times over can cause the GMSK demodulator to give out bit errors.

All problems of this type can be avoided by the use of a data scrambler or randomizer in the modem design. The Vfast28.8 modem includes this function in the modem controller device. Because the data will still contain some low frequency content, the radios must be able to carry, without distortion, frequencies as low as 30 Hz in transmit and 40 Hz in receive. The upper frequency limit required is dependent on the data rate used.

Considerations

The Vfast28.8 full-duplex radio modem provides excellent performance in the most demanding conditions. When used at 9600 bps it is compatible with other modem designs. However, it is capable of much more. Both versions, the AX384 and the AX576, include the K9NG data-randomizer as a default option. The GRAPES randomizer is also included. However, the user can also select the alternative method of data coding, known as "bi-phase coding," as described above. This makes interfacing to typical voice radios much easier.

A unique feature in both modems is the inclusion of a "real-time bit repeater." This allows the user to install a contention-free LAN in an area.

The operation is as follows: The repeating station is equipped with an AX384 or AX576 TNC and a full-duplex radio. This radio has split transmit and receive frequencies. The stations wishing to use the repeater use split frequency half-duplex radios. This is the same situation as with a voice repeater. As soon as one of the user stations starts to transmit data, the repeater keys its transmitter and starts to relay the input data. As soon as the other user stations detect that the repeater is sending they are inhibited from transmitting. Thus all contention to access the repeater is avoided.

Since the data is present in real-time, this is unlike a normal node, where the packet must be fully received before it is forwarded to its end destination. The bit repeater in the AX384 and AX576 includes full data bit rate clock regeneration to avoid excessive clock jitter on the repeated data. It also includes an extending FIFO buffer to ensure bits cannot overrun or underrun where the bit rate clocks of the user stations and the repeater are slightly different.

Software and setup

The main operating software ROM supplied includes a KISS mode driver for the TNC and a Setup program. For many users such as those running G8BPQ Node, KA9Q TCP/IP, and Linux AX25 software, this is all that is required. The Setup program allows the user simply to configure some TNC and modem functions. It may be driven by a simple terminal program or a Windows™-based program (supplied with the TNC).

The Setup mode is activated by holding in the "Setup" button while switching on the TNC. It also allows various test signals to be generated by the radio modem to enable the user to get the best performance from the connected radio equipment. When used on a radio link with an AX384 or AX576 at each end, the users may do bit error rate measurements on the link to allow fine-tuning of the RF equipment for best performance.

As you can see, the AX384 and AX576 are state-of-the art TNCs, yet they are available in both kit and assembled versions. Full user documentation is

Continued on page 45

WeatherWarn Goes Public

Build yourself a real-time weather monitoring interface.

Phillip Carino AG8U
3798 Keeweenaw Drive NE
Grand Rapids MI 49525
[http://www.qsl.net/ag8u]

WeatherWarn™ is a concept I developed and implemented back in 1989. Its purpose is to alert me, via ham radio, when severe weather is forecast and/or when severe weather is imminent. It is a means by which a weather-alert monitor connects to a VHF ham radio and an autodial pager through an electronic interface.

This interface activates outputs that drive devices to perform certain tasks, such as buzzers, lights, radio DTMF tones, autodial alarm systems, etc., depending on what the user needs. It responds to the weather-alert monitor siren from a contact closure, digital pulses, etc.

WeatherWarn can be used with ham radio transceivers, scanners, handhelds, repeater controllers, home alarm systems, etc. By knowing the interface requirements, you can custom-design the interface to control specific devices. The siren is activated from the National Weather Service's NOAA Weather Radio Network.

[WeatherWarn™ and WxWarn™ are US trademarks assigned to the author and copyright © 1989–1998 by him under US copyright #461-226. He is now releasing the circuit design for use or modification by the public. — ed.]

NOAA Weather-Alert System

The NOAA Weather Radio Network Alert System is a countrywide network of weather transmitters that relay current and forecast weather information from meteorologists at National Weather Service offices within the United States. When severe weather conditions warrant, the NWS activates weather-alert tones that are transmitted on NOAA radio frequencies. These frequencies are received on weather-alert receivers that can be purchased locally. These receivers generate loud sirens when in receipt of these weather-alert tones. Thus you have real-time, 24-hour-a-day weather monitoring and alerting within most areas of the US.

WeatherWarn theory of operation

WeatherWarn is triggered by a siren in the weather-alert monitor's internal speaker. The weather monitor I use is an older Radio Shack® wood-grain version. They have superseded it with a new model that functions the same way. The siren is a 1050 Hz single tone. This tone is sampled and detected by the WeatherWarn interface's front end.

After receiving this tone for a predetermined time, the interface reacts by driving multiple comparators which connect to appropriate outputs (buzzers, relays, timers, etc.). After the alert monitor siren stops, the interface active-outputs go back to their pre-active states, waiting for the process to start again. The weather monitor's speaker is muted until NOAA radio transmits the 1050 Hz tone.

General circuit interface description

The interface inputs consist of the alert monitor's speaker output and a nine-volt tap from an internal pickoff point at the monitor's battery connection. The speaker audio connects to a two-stage, high-impedance, low-pass filter. This is a second-order filter at -40 dB per decade of frequency. See **Figs. 1** and **2**. The output from the low-pass filter charges an R/C network for a predetermined time. When the voltage reaches a certain threshold, determined by the comparator's voltage divider network, the comparators toggle their output states.

These outputs then drive the appropriate devices to which they are connected. After the comparator's reference level drops, the interface returns to its

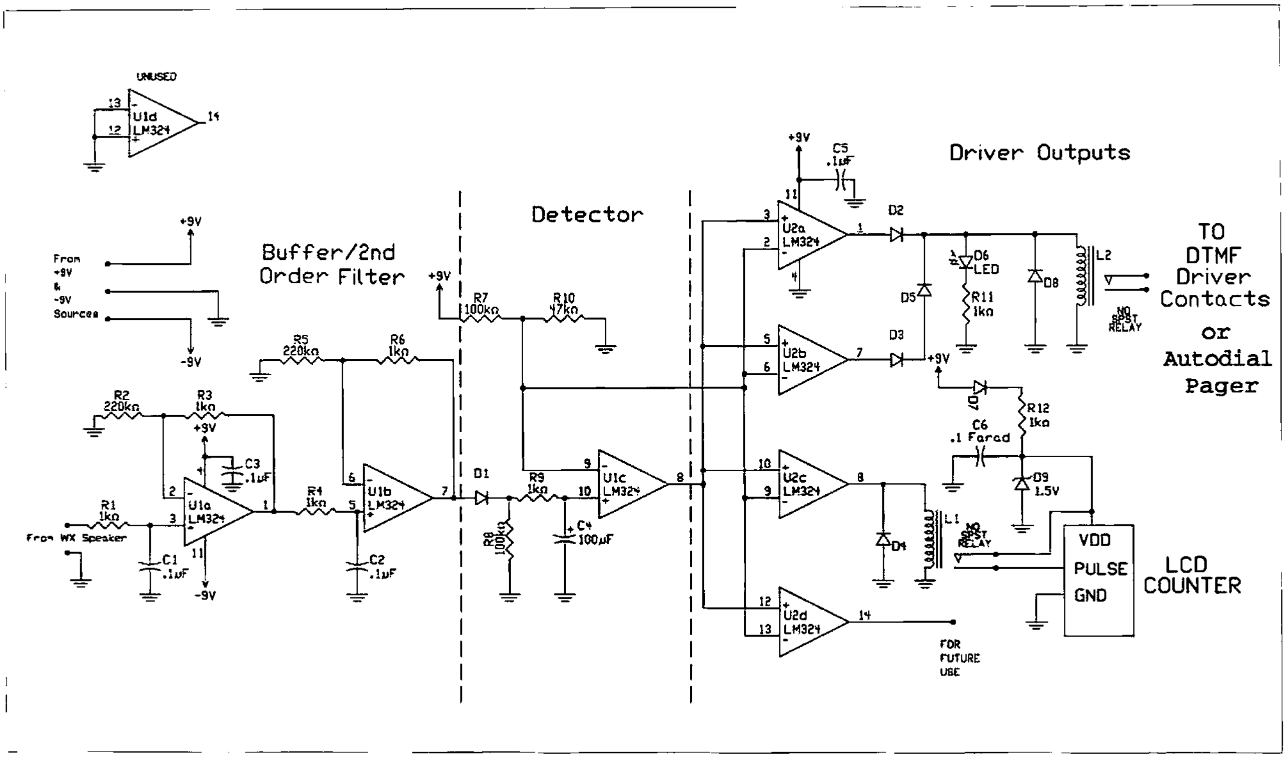


Fig. 1. WeatherWarn interface schematic. Unless otherwise specified, all diodes are 1N4007, all resistors are ±5%, and all capacitors are +16 V.

standby mode, waiting for the next siren. With the existing design, when you're listening to weather from the monitor, you should lower the volume to prevent the interface from activating. Human speech is typically from 300–3000 Hz. Modifying the input filtering by adding additional second- or third-order filters can sharpen the input response "skirts" to prevent ordinary audio from triggering the interface.

Detailed circuit interface description

Op amps U1A and U1B are cascaded to produce a second-order, low-pass filter. R1,C1 and R4,C2 set the filter's cutoff frequency using the following formula:

F = 1/2πR x C.

At cutoff, the output voltage is -3 dB from the rail voltage of +9 V. Op amp U1C detects the siren after a preset time-constant calculated from R9 x C4. D1 prevents C4 from discharging into U1B. R8 is used to drain the capacitor charge if U1C's input pin 10 opens up. R7 and R10 form a voltage-divider network that sets the trigger voltage.

When the voltage from the siren goes above this voltage, U1C's output goes high and the output states of the drivers go active. Op amp U2 has four op amps that are used to operate or drive the appropriate outputs connected. U2A and U2B drive the main relay that operates my VHF amateur radio.

D2, D3, and D5 ensure that only one op amp drives the relay instantaneously. If one output opens, the other output will continue the operate the relay. D4 and D8 attenuate high, negative voltages that are produced when the relays go from active to inactive states. All diodes are 1N4007, high-PIV-rated. Both source (rail) supply voltages are needed for proper filter response. You can use a single +9 V source, but the filter frequency response and output voltage may change when trying to filter the 1 kHz incoming tone. R2, R3, R5, R6, R7, and R10 may have to be changed when using a single supply voltage. *Note:* The monitor's supply voltage is *not* regulated. When the siren activates, the supply voltage drops from 9 V to approximately 3 V. Please verify that the reference voltage between R7 and R10 is correct for proper triggering.

Fault tolerance

I have designed WeatherWarn to be used in a high-frequency, high-static environment. Its first remote application was with a computer-controlled repeater system, housed in a remote area. I chose to incorporate standard fault-tolerant designs/components to ensure that the outputs do not change state due to noise, static, etc. The following "hardening" was used:

•The use of commercial-grade op amps (LM324) provides for cold temperature operation.

•Tantalum capacitors provide high-frequency response.

•Grounding all unused IC inputs reduces noise pickup.

•Isolating the buffer/filter from the driver comparators, by using two separate ICs instead of one, reduces the chances of false triggering if the front-end filters are destroyed.

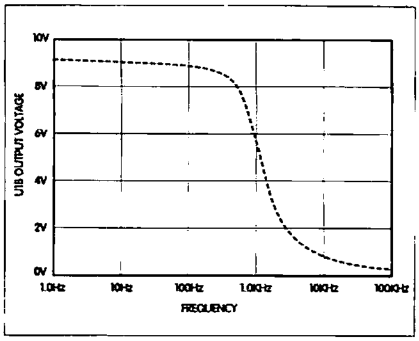


Fig. 2. WeatherWarn frequency response curve.

•Double-driving the output relay provides redundant outputs in case one output fails.

•DC input can be protected by using reverse-voltage diodes, high-frequency filter capacitors, and chokes if necessary.

•Two ground inputs from the weather monitor—one from the speaker and one from the DC source, isolate the audio ground from the power ground. This keeps the logic-level reference ground at or near zero volts for proper operation.

Output devices

My existing interface drives an LED, a relay, and an LCD counter. The relay is normally open (N.O.) and connected in parallel with a key on my DTMF microphone. When WxWarn activates, the LED turns on, the LCD counter increments by one, and my base VHF radio sends a DTMF tone on a pre-chosen frequency to the dual-band radio in my car. My HT is tuned to receive that signal, which is duplexed from my car. My interface is very cost-effective and provides me with a few desired functions. Some other ideas for output devices could be buzzers, triac-driven lights, autodial alarm systems that dial a programmed number, 555 timers, voltage-to-frequency converters, microprocessors, etc. 73, and enjoy!

Web page

Please address any questions, comments, or creative ideas to me via my personal Web page, whose URL is shown at the top of this article. My site is devoted to weather data/images, WeatherWarn, and free utility software I have designed. 73

Parts List

R1, R3, R4, R6, R9, R11, R12	1 k resistor ±5%
R2, R5	220 k resistor ±5%
R7, R8	100 k resistor ±5%
R10	47 k resistor ±5%
C1, C2, C3, C5	0.1 µF 16 V
C4	100 µF 16 V
C6	0.1 F 16 V
D1, D2, D3, D4, D5, D7, D8	1N4007
D6	LED
D9	1.5 V zener
U1, U2	LM324
L1, L2	N.O. relay, SPST
LCD counter	Builder's choice

Table 1. Parts list.

Brits Get Gaussian

continued from page 42

included in electronic form along with a Windows™-based program to control the Setup mode. The construction is from high quality materials including an RFI-screen-coated stylish gray casing. The styling is designed to match well with modern office and computer equipment. The PSU is extensively filtered and smoothed to ensure correct operation of the TNC even in the presence of strong RF fields.

This TNC is being used in the local East Anglia area as the basis of our high-speed backbone, hopefully operating at 19,200 bps full duplex on 23 cm. Some problems are being experienced with the RF gear for 23 cm at present, but hopefully these will be resolved soon. For anybody looking for a high-speed TNC, at up to 57,600 bps, this would be an ideal answer.

For further information, contact GMSK Data Products, 80 Clone Road, Halstead, Essex CO9 2HP, UK. E-mail: [sales@nuthatch.dungeon.com] or [info@gmskdata.co.uk]. Web site: [http://www.gmskdata.co.uk]. 73

How Safe Is Your Mobile?

Assuming you want to know ...

Robert W. Vreeland W6YBT
45 Maywood Drive
San Francisco CA 94127

During much of last year, the FCC repeatedly yielded to pressure to relax its RF safety regulations. First stations running less than 50 watts, and then push-to-talk mobiles, were exempted from evaluation. Then the deadline for evaluation was extended from January of 1997 to January of this year. Now they have ruled that amateur stations running less than the specified power level on each band are exempted from evaluation.

Unfortunately, relaxing the safety regulations may not be in the best interests of amateur radio. Don't we realize that the rules were written to protect us? Although the ham who complies with the new power limitations may never be required to evaluate his station, a prudent operator will make measurements or calculations to ensure that his station is safe. At W6YBT, we measure field strength with a calibrated hula hoop, as described in my article in the June 1997 issue of *73*. Unfortunately, both measurements and calculations have limited accuracy, so why not do both and compare the results? We have done this in the two-meter near field, and here are our findings.

Most field strength calculations start with the premise that an antenna is a point source that radiates equally well in all directions. Of course, we know that this isn't true, but we have to start somewhere. We can apply corrections later. This idealized radiator will spread the transmitted power evenly over the surface of an imaginary sphere. In other words, the amount of power falling on each square meter of the sphere's surface will be the total transmitted power, divided by the surface area of the sphere. Since the surface area of a sphere is $4\pi r^2$, the power density (S) in watts per square meter will be

$$\frac{P}{4\Pi D^2}$$

where P is the effective radiated power in watts and D is the radius of the sphere in meters. We use D for distance, since the radius of the sphere is the distance between the antenna and the sphere.

Now I want to convert power density into field strength (E) in volts per meter because that is what my field strength meter measures. Ohm says that

$$P = \frac{E^2}{R}$$

or

$$E = \sqrt{PR}$$

In this case,

$$E = \sqrt{SR}$$

where S is the power density in watts per square meter and R is 377 ohms, which is the resistance of free space. So

$$E = \sqrt{\frac{P \times 377}{4\Pi D^2}} =$$

$$\frac{\sqrt{30P}}{D} =$$

$$\frac{\sqrt{30ERP}}{D}$$

where ERP is the effective radiated power (i.e., transmitter output times antenna gain). Richard Tell has used this equation in "Broadcast Radiation:

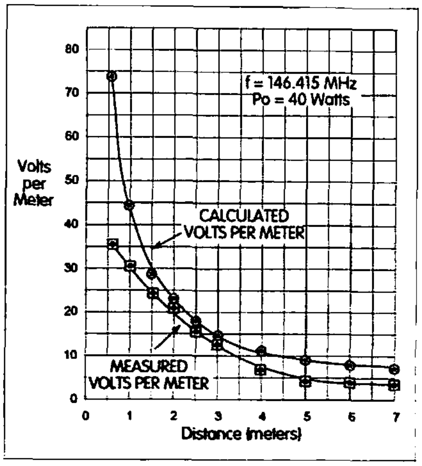


Fig. 1. Comparison of calculated and measured near field strength from a 40 W two-meter station.

How Safe is Safe?", *IEE Spectrum*, June 1997.

Now we must correct for antenna gain. Since our antenna is a dipole, its gain is 1.64 relative to a perfect point source. Also, our transmitter output is 40 watts. Our formula then becomes ERP = 1.64 x 40, and

$$E = \frac{\sqrt{30 \times 1.64 \times 40}}{D} =$$

$$\frac{44.36}{D}$$

where E is the field strength in volts per meter and D is the distance from the transmitting antenna in meters. A plot of this curve is shown in **Fig. 1**. Also plotted are readings taken with a spectrum analyzer and a calibrated biconical antenna.

The transmitting antenna was a horizontal dipole cut for the two-meter band and tacked to a fence four feet above ground. The measuring antenna was also horizontal. It was mounted on a tripod four feet above ground.

The calculated and measured curves (**Fig. 1**) compare surprisingly well at distances of one and a half or more meters from the transmitting antenna. Is this dumb luck? Or perhaps a case of two wrongs making a right? Who knows? It should be noted that no correction was made for ground reflections. The transmitting and receiving antennas were both horizontal balanced dipoles. A series of readings at various heights above ground was taken with a hand-held E-field meter at a distance of two meters from the transmitting antenna. The results (**Table 1**) led us to believe that there was negligible ground reflection. The readings should be regarded as relative only. I don't trust hand-held E-field meters.

Now that we have a handy field strength formula, let's do some doodling. Suppose you buy one of those nifty 5 dBd (7.14 dBi) two-meter monopoles and mount it on the trunk lid one and half meters behind your child's car seat. There will be 100% ground reflection from the trunk lid. However, you can ignore it because the manufacturer is pretty sure to have included this in his advertised gain. Then antenna gain (7.14 dBi) is a factor of 5.18 power gain. Let's say you are running 40 watts output. The effective radiated power will then be 5.18 times 40, or 207 watts. So E =

$$\frac{\sqrt{30ERP}}{D} =$$

$$\frac{\sqrt{30 \times 207}}{1.5} = 52.5$$

volts per meter at the child's car seat. The FCC limit for this frequency range is 27.5 volts per meter. However, we are allowed to do power averaging. If you are transmitting half of the time and listening half of the time, your average effective radiated power will be 207/2 or 103.5 watts. When we plug this into our formula we get 37.1 volts per meter. Still too high. (Power averaging over a half hour doesn't make sense to me.)

If we look at the curves (**Fig. 1**), we don't know which curve is more accurate, but the measured values appear to be. The calculated values seem to go wild at a distance of one meter or less. At a distance of one and a half meters, the calculated value was 29.5, whereas the measured value was 24.3. This ratio is 24.3/29.5 or 0.824. If we use this ratio to scale our reading of 37.1 volts per meter, we get 30.6. This is still above the FCC limit of 27.5 volts per meter.

Height (feet)	Volts per Meter
0	15
1	32
2	58
3	80
4	90

Table 1. Readings taken at various heights indicate the absence of significant ground reflection at a distance of two meters from the antenna.

So what now? Since you own your car and since you know that your child is being exposed and you can legally speak for him, perhaps the car can be described as a "controlled environment." In that case, the maximum allowed field strength will be 61.4 volts per meter. Somehow this doesn't make me feel any better, but draw your own conclusions. Remember that according to the new FCC regulations, your mobile installation is exempt from evaluation for two reasons. First, you are running less than 50 watts transmitter output, and second, it is a push-to-talk mobile. 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

1998 Collected Works

And work it was! The Never Say Die editorials for the first four months of 1998 have been reprinted in larger, more easily readable type for you doddering old-timers. 82 editorial segments, without the usual gerrymandering through the magazine, and complete with an index. 1998 Volume 1 of the Secret Guide to being Healthy, Happy, Wealthy, and Wise runs 92 pages and is available for a measily five Federal Reserve Notes, which are worth every bit of the paper they're printed on.

Gluttons for mental exercise can invest $15 in the 1997 Collected Never Say Die Works, which runs to 240 pages. Just call Chris at 603-924-0058 with your Visa or MasterCard.

Say, while you're at it, have you started on the educational program your college should have provided, but didn't, by getting Wayne's Guide to Books You're Crazy if You Don't Read? It's only $5 more. Wayne's sorted through thousands of books and reviewed the ones which will give you the best in straight dope on a wide variety of subjects. No, he/we don't sell the reviewed books. This is a reading guide, not a catalog.

There's a $3 s/h charge on any total order, so the more books you buy at one time, the better you do. Maybe it's time to get the $10 Bioelectrifier Handbook?

Wanted

Fun, easy-to-build projects for publication in 73.
For more info,
write to:
Joyce Sawtelle
73 Amateur Radio Today,
70 Route 202 North,
Peterborough NH 03458

QRX

continued from page 8

the years have come from amateurs just like you! Just get out that 35 mm camera with some color print film in it, get the shots in focus, and use a vertical orientation. And don't forget to stay back far enough from your subject to leave some room above and to the left of it for our magazine title and cover blurbs. No, you don't have to have the prints blown up. Just send us regular 4 x 6 color prints. Of course, the bigger the better, but normal will do just fine.

There's nothing to shoot. Right. How about Field Day? How about public service events, emergency operations, club meetings and activities? And while we do see a lot of shacks and antennas, those too can be winners—if the shot's formatted well, with a fresh look. Got any good DXpedition or portable or mobile shots?

Why not have some fun with it? Look for those great angles you get from climbing above or shooting from below your subject. Stage shots if you like (but be sure to tell us if that is the case). Make sure the sun is at your back. Be sure to use a flash if needed or even if you're in doubt. Let us see some recognizable human faces. Give the camera to the XYL or harmonic and let *them* shoot *you*. Or make a copy of this and take it to the local photography club or school class—maybe *they* could use some extra dough.

OK? The deadline is whenever you're ready, but be advised that sooner is better than later and increases your chances of acceptance significantly because you want to get your prints here before we book the upcoming cover schedule. But anytime could be OK.

Mail your color prints to Cover Shots, *73 Amateur Radio Today*, 70 Rte. 202N, Peterborough NH 03458. Be sure to include descriptions of what the shots are, and an SASE if you want the prints returned.

One more thing: If you're writing an article for us, be sure to take some cover possibilities to go with it! You increase its chances of being accepted, and you get more bucks if it is! And if you're not writing an article for us, why not? Just send for *How To Write For 73*, at the address above.

Who's Who in Ham Radio

Novice:

Makes high marks on the wall when trying to leap small buildings; is run over by locomotive; can sometimes handle a gun without inflicting self-injury; talks to animals.

Tech:

Falls over doorsteps when entering buildings; says, "Look at the choo-choo"; wets himself with water pistol; plays in mud puddles; mumbles to himself.

Technician (old):

Barely clears a Quonset hut; loses tug-of-war with locomotive; can fire a speeding bullet; swims well; is occasionally addressed by God.

Tech-Plus:

Runs into buildings; recognizes locomotive two out of three times; is not issued ammunition; can stay afloat with a life preserver; talks to walls.

General:

Leaps short buildings in a single bound; is more powerful than a switch engine; is just as fast as a speeding bullet; walks on water if the sea is calm; talks with God.

Advanced:

Leaps tall buildings in a single bound; is more powerful than a locomotive; is faster than a speeding bullet; walks on water; gives policy to God.

Extra:

Lifts buildings and walks under them; kicks locomotive off track; catches speeding bullets in teeth and eats them; freezes water with a single glance; *is* God!

Author unknown, reprinted in *NOARS LOG*, newsletter of the Northern Ohio Amateur Radio Society (November 1997).

The DXpedition

5:00 a.m.: Fellow DXers arrive. Crawl out of nice warm bed.

5:30 a.m.: Toss all gear into truck.

5:45 a.m.: Get gear out of neighbor's truck, put it in yours.

6:00 a.m.: Get speeding ticket while hurrying to get to the mountains.

7:15 a.m.: Arrive at "the site," near top of mountain.

7:16 a.m.: Start unloading gear.

7:20 a.m.: Get poked in eye with 20 m vertical by fellow DXer.

7:50 a.m.: Arrive at hospital to get eye patched up.

8:30 a.m.: Get another speeding ticket while heading back up to mountains.

8:45 a.m.: Arrive back at site. Unload antennas yourself this time.

9:45 a.m.: Hike up to mountaintop. Pass out from exhaustion.

9:50 a.m.: Wake up to smelling salts and laughter from fellow DXers.

10:00 a.m.: Put up antennas, and set up rigs.

10:15 a.m.: Fire up rig, call CQ for half an hour; no replies.

10:46 a.m.: Hook up coax to rig ...

10:48 a.m.: Realize that finals are wasted in main rig.

10:50 a.m.: Hook up backup rig, this time with coax.

11:00 a.m.: Yell CQ, rare VP8 comes back; antenna falls down ...

11:15 a.m.: Wake up to smelling salts, fellow DXers shaking their heads.

11:30 a.m.: Guy antennas.

12:05 p.m.: See long list of QSOs made by fellow DXers.

12:06 p.m.: Notice rare VP8 in logbook.

12:07 p.m.: Beat fellow DXer over head with logbook.

12:09 p.m.: Restrained by rest of DXpedition team.

12:30 p.m.: Back to rig for another attempt.

12:35 p.m.: Nearby lightning strike kills receiver. Notice wet pants ...

12:36 p.m.: Look for shelter.

12:38 p.m.: Find cave!

12:41 p.m.: Watch antenna get struck by lightning while hiding in cave.

12:42 p.m.: Wish it was fellow DXer's antenna, or him, that was struck.

12:45 p.m.: Realize you're not alone in cave ... smell bad breath of the ages.

12:46 p.m.: Pick up really big rock.

12:47 p.m.: Mauled by large angry bear.

12:50 p.m.: Get pulled out of cave by fellow DXers.

1:05 p.m.: Finally talked into receiving medical treatment.

1:30 p.m.: Arrive back at hospital.

1:55 p.m.: Receive series of painful rabies shots and multiple stitches.

2:30 p.m.: Get out of hospital and return home.

2:35 p.m.: Explain stitches and eyepatch to wife.

3:00 p.m.: Realize gear is still up on mountain, with bear.

3:01 p.m.: Wish fellow DXers were still up on mountain, with bear ...

3:03 p.m.: Consider taking up drinking.

7:00 p.m.: Get phone call from DXer buddies.

7:05 p.m.: Agree to go on DXpedition again tomorrow.

Lifted from the March 1998 *ARNS Bulletin*, which gave credit to the January 1998 issue of *Amateur Radio Horizons*, newsletter of the Lockheed Martin Employees Recreation Association ARC, Jim Woods KC7FG, Editor.

FCC Computer System Back On Line

The FCC has its amateur radio licensing computer system back on line. The wayward system sprang back to life on Friday, February 20th, and began processing the backlog of applications. The system went down on February 10th. No paper or electronic applications were processed for nearly 11 days as FCC personnel in Gettysburg attempted to troubleshoot the problems with the system.

Gettysburg personnel first processed data submitted on February 11th and 12th by VECs and had an updated file available for the Internet callsign servers on February 21st. Since the initial processing went well, VECs then sent on the applications they'd been holding back at the FCC's request. By February 26th, it was business as usual.

Gettysburg had caught up with the backlog and ran a batch of vanity applications, although a number of applications remained in the work in process stack.

The FCC offered no explanation for the computer breakdown, but did apologize to the nation's Volunteer Examination Coordinators for any inconvenience the breakdown might have caused.

TNX Bill Pasternak WA6ITF at *Newsline*, via FCC, ARRL, and Mike Mettler WW8MM of *Amateur News Weekly*.

Nominate the "Young Ham of the Year"

The nominating period for the 1998 Young Ham of the Year is open until June 30, 1998. Originally known as the "*Westlink Report* Young Ham of the Year," this award, now in its second decade, is presented annually to a United States licensed radio amateur who is 18 years of age or younger. Any continental United States (FCC licensed) ham radio operator 18 or younger who has used amateur radio to contribute to the benefit of the amateur radio service, the state of the communications art, their community or the nation is eligible to be nominated.

All nominations must be submitted before June 30 on an official application. Application forms are available for a self-addressed stamped envelope mailed to:

1998 Young Ham of the Year Award
c/o *Newsline*
28197 Robin Avenue
Santa Clarita CA 91350.

Six Meter Scholarship

The Six Meter Club of Chicago is offering a scholarship through the ARRL Foundation to any eligible college student who holds an amateur radio license and who resides in the "9" call district. Those interested in applying should write to:

The Six Meter Club Scholarship
c/o ARRL Foundation
225 Main Street
Newington CT 06111.

Another FCC Computer Glitch?

A New England ham is protesting an FCC mistake that reassigned his old callsign to another radio amateur before the end of the two-year waiting period.

The problem began when Ron Toller N1RT learned that the FCC had reissued his former callsign, WO4L, to a Florida man less than 12 months after Toller gave it up in 1996. The FCC's vanity rules state that callsigns will be held out of the pool for two years before being reissued.

Toller said a spokesman at the FCC's Gettysburg office blamed the premature release on a computer glitch. The same spokesman told the ARRL that by the time the FCC discovered its error, it decided not to rescind the grant, because of the number of licenses that had been granted by then, and the amount of time that had passed before the problem was discovered.

Toller's take on the turn of events differs. He says that if all the hams must obey the rules, so should the FCC. He says he's petitioning to have the FCC vacate WO4L until the two-year period is up in November. N1RT says that the commission has an obligation to adhere to its own rules and he wants the grant rescinded.

From the ARRL, via Bill Pasternak WA6ITF at *Newsline*.

Number 50 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

A surplus 1152 MHz synthesizer

Well, the SuperBowl will be over by the time you read this column, but for me things have been getting hot and heavy in videoland. I work for Pacific Bell video service here in San Diego and we are handling a large portion of the SuperBowl video operations. I'm jotting a few notes for this column while waiting for things to heat up, as it's some seven hours to kickoff and the suspense is mounting. San Diego is in turmoil and very active for a time and place that is supposed to be a sleepy Sunday morning in paradise. The weeks of preparation and work have all come to focus on just one moment in time, for big business and the football event of the year. Born and raised in Wisconsin, I'll always root for Green Bay—but as we know now, they did not win. It was a great game by all standards and very enjoyable in any case.

On to this month's material as promised: the conversion of a very high-quality synthesizer board from Qualcomm that is used as an excellent local oscillator or marker for 1152 MHz. This board, after conversion, can be used for several things besides a converter for 1296 MHz. Its main attribute is the ability to generate a very important frequency for amateur microwavers, 1152 MHz. This frequency is so important because it is the base prime number for a frequency stacking plan that is used to formulate all microwave frequencies.

The harmonics of a very accurate 1152 MHz source can be used as spot points of reference at the frequencies of 2304 MHz, 3456 MHz, 5760 MHz, and 10368 MHz—all the weak-signal microwave band operating frequencies. Even 24192 MHz is possible, as it is divisible by 1152 21 times. All the listed microwave frequencies are divisible by 1152 MHz. That means that if you have an accurate 1152 MHz reference source and have harmonics generated, you can produce a very accurate frequency marker spaced at 1152 MHz. This harmonic can be used to test receivers and provide assurance of frequency accuracy, removing a wobble in your microwave operation.

The synthesizer used in this project was obtained from Qualcomm, an equipment manufacturer of very high quality communications systems. The name Qualcomm is a composite of QUALity and COMMunications and correctly befits their equipment, which is very high quality. This surplus material that is made available comes from older systems being updated after many years of service. We purchase this surplus material and remove components and portions of the original system that can be used in amateur activities. By removing circuit boards and other devices from their original package, we ensure that no complete unit will come back to haunt Qualcomm.

Qualcomm is very gracious in that they allow us to utilize their material for amateur purposes. The main use is modification of portions of systems used for microwave communications. The modifications required to adapt to amateur operation are minimal. Without Qualcomm's cooperation and assistance, many scores of amateurs otherwise would not have had the opportunity to utilize such exotic and new state-of-the-art materials. (Please direct all questions concerning this material to me.)

The synthesizer PC board to be modified for 1152 MHz is larger than other synthesizers previously described. The main difference with this synthesizer is that its VCO functions at a lower frequency (in the 800 MHz range), while the VCOs in other units I have described work in the 2-plus GHz range. The basic synthesizer chip is similar in all units and capable of stand-alone operation to 1.6 GHz. In the 2.6 GHz synthesizer it has an onboard divide-by-two, allowing the synthesizer chip to function at 1.3 GHz while the local oscillator works at 2.6 GHz.

There are two different synthesizer chips used in this synth oscillator board. The later production chip, a CMOS version, is renumbered 3216 and identical to the original 3036 chip. The main difference is that the newer chip is a reduced-current CMOS unit drawing 150 mA less than the original 3036, which requires 400 mA for operation. The 3036 and this 3216 CMOS chip are interchangeable, being pin-for-pin compatible. The benefit with the newer 3216 is mainly that it is a much cooler chip that does not require heat sinking.

The conversion of a surplus synthesizer board begins with cutting pins 2, 5, 19, and 22 from their solder pads and gently lifting the pins up to ensure they are open. These pins are pulled high in logic with internal pull-up resistors. Be cautious that you do not damage other pins as you cut these pins—and only these pins. It's very hard to resolder a broken pin or a pin that is removed in error, as they do not like to be moved about much.

Cutting the pins is a one-time operation. Be sure to count the

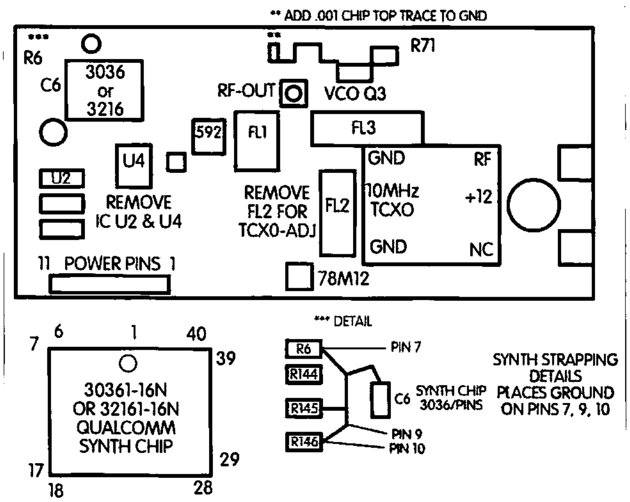


Fig. 1. Block diagram of the Qualcomm synthesizer board. Originally intended for operation near 800 MHz, it is converted to 1152 MHz for marker or local oscillator use. Board size is 5 by 9-1/4 inches. It sports a high-accuracy onboard 10 MHz TCXO.

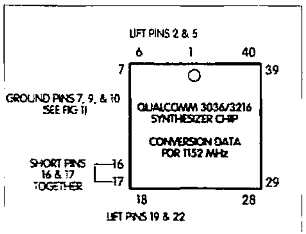


Fig. 2. Pin-for-pin conversion of Qualcomm synthesizer to 1152 MHz. Leave all other pins as they are.

pins carefully—don't just throw caution to the winds and jump in. It's much easier to avoid a counting error by being careful and counting first than it is to retrace your counting steps, find an error, and have to correct it. Just as the old adage goes, measure a board 20 times but only cut once.

Next, several resistors to the top left of the synth chip—resistors R6, R145, and R146—are strapped together along their righthand side and tied common to the top of capacitor C6. See **Fig. 1** for details of operation. The resistors' right side is tied directly to the 3036 synth chip pins 7, 9, and 10, which need to be grounded. Tying them together and shorting them to the top of C6 grounds all these pins. C6 top is a direct ground connection and was available in the vicinity.

Additionally, pins 16 and 17 need to be tied to ground. Short with a solder bridge pin 16 to pin 17 to satisfy pin 16's being grounded, and then wire pin 17 directly to ground. Next, ICs U2 and U4, as shown in **Fig. 1**, need to be removed from the PC boards. Cut all the pins on one side of either chip. Lift and break off the remaining side by flexing the chip about. After the chips are removed, you can use Solder-Wick™ to remove the pins still attached to the PC board for final cleanup or leave the pins where they are, as long as nothing is shorting out.

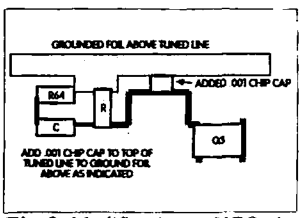


Fig. 3. Modification to VCO circuit on synthesizer board to convert original VCO frequency from 800 MHz range to 1152 MHz. Add .001 µF chip capacitor from top of printed inductor to ground. This bypass capacitor increases VCO frequency from 700 MHz to 1200 MHz.

The VCO is the last item to be converted to our new operating frequency. Normally it runs in the 800 MHz region. As is, it will not pull up to 1152 MHz without modification to its circuitry.

The modification is quite simple and shown in **Fig. 3.** Locate the Q3 transistor just above the RF output coax connector. Going off to the right of Q3 is a stripline inductor which is the 800 MHz VCO tuned line. To convert it to 1152 MHz, place a chip cap on the top center of the tuned line and solder it to the ground foil just above the tuned line. Solder the other end of the capacitor to the center of the top tuned line as shown in **Fig. 3.** This bypass capacitor increases the tuned line to resonate in the 1 to 2 GHz region and is not critical.

Check all work operations for solder bridges and obvious shorts after conversion is complete. Check the power pins (1 to 11) on the power connector. Pins 1 and 2 are the +15 volt DC input. Pin 3 is PC board ground, and pin 4 is +5 volts DC. There is an onboard voltage regulator from the +15 volt line to 12 volts regulated. Its location is just below the FL2 and is labeled 78M12.

If you want the most accuracy and can verify that the 10 MHz TCXO oscillator is set to exactly 10 MHz, remove FL2 with a pair of pliers by breaking it off the PC board. I had great trouble in trying to remove this filter with a high wattage soldering iron and do not recommend unsoldering it. Instead break it off with an easy twisting as this puts less strain on the entire PC board.

Once the FL2 is removed, you can now get access to a small patch of aluminum tape on the side of the TCXO. Removing this tape gains you access to the Johanson VCO trimmer crystal adjust capacitor. Adjusting this capacitor will allow you to set the oscillator to precisely 10 MHz. Replace the foil tape when completed. This keeps internal circuitry somewhat insulated from drafts, which can affect the internal circuitry directly.

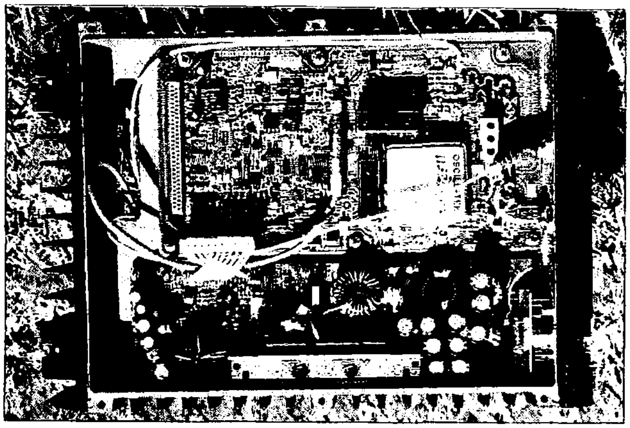


***Photo A.** Completed 1296 transceiver using 1152 synth board. Unit power supply is at bottom and 1152 synthesizer above. 3036 synth chip at upper left. Large silver-colored unit near middle right is the high-precision 10 MHz TCXO. Synth PC board size is 5 by 9-1/4 inches.*

Power up the synthesizer and observe a small LED just above pin 1 on the 3036 synth chip. While turning on power this LED should briefly turn on, the extinguish indicating phase lock is good. Trust me here: If the LED is out, the frequency output is

Continued on page 52

almost exactly 1152 MHz and can only be off if the 10 MHz reference is way off frequency.

Power output can be taken from monitor coax connector, or a short piece of miniature coax can be soldered to this connection for test connections. Output power available from this coax connector is about zero dBm. Power can be increased by running through an external MMIC amp or further modification to the MMIC in the transmit section of this PC board.

A further modification is to connect the coax connector to the MMIC amp in the upper left corner and use it for an additional 12 to 14 dB of gain at 1152 MHz. To use the MMIC onboard op amp, cut the input and output traces on the PC board and with +12 volts to the resistor feed for the MMIC amp. Connect the coax connector to the input capacitor of the MMIC and tie another short section of coax cable and connector to the output. You should obtain about +14 dBm for converter or harmonic drive using the MMIC to amplify the VCO signal.

Now that the unit is finished, it can be mounted in a suitable metal box with its power supply—be it 12 V DC or 110 V AC. This unit can be brought out in two different levels, the first being the low-level 1152 MHz at the coax connector just below the VCO transistor (Q3).

The second output, the high-level from the MMIC amplifier, is brought out to a coax connector for easy connections. A simple harmonic amplifier can be adapted for use by taking a common 3.7 to 4.2 GHz LNA amplifier and removing the waveguide flange and input circulator (with band saw or hacksaw, as necessary). Add a 10 pF chip capacitor to the input stripline and place a coax connector on the other end of the capacitor to isolate the amplifier input with the capacitor.

Take an X-Acto™ knife and cut away all the tuning stubs on the main stripline, making the amplifier broadband in nature. Do not cut the voltage feed RFC very narrow lines feeding the gate and drain leads. When finished, the TVRO LNA is now very broadband in nature over some 3 GHz or more of frequency, from 800 MHz to over 4 GHz.

Driving the input of the LNA with the zero dBm port, the amplifier will be driven into saturation, making it rich in harmonics at which output will occur. With 1152 MHz input there will be 2304 MHz, 3456 MHz, and 5760 MHz output markers. The high level port (+14 dBm port) can be used to construct a 1296 MHz transverter.

Add a mixer and inject with 1152 MHz for the local oscillator, and with a 144 MHz IF you are now on 1296 MHz multimode or whatever your rig at two meters can function at. Add a receiver preamp and power stage for transmit and that's all there is to it.

The local oscillator seemed to be the stumbling block for many amateurs in constructing a building block system for microwave operation. Now we see that the frequency can be quite pure and extremely accurate even when a scheme is used to separate the harmonics and use them for injection with suitable filtering and amplification to a specific frequency of use. Just imagine a single local oscillator generating a single frequency and being used to function at other frequency bands as an accurate local oscillator.

It's all possible, just as it is up to your imagination to figure out just what you want to construct to function in the microwave realm. This unit will provide a very stable, accurate marker, so its prime use toward this end can be accomplished. I am very satisfied with its operation, and even finished the 1296 MHz rig at a low power transmit level. Soon, I plan to increase the power to about two watts.

If making a similar marker for your workbench or field microwave use interests you, I can supply you with one for $75 plus $4 postage. If you want a unit that is converted (modifications done) and ready for adding external connections, add $40. I will make a limited number of units available in this converted manner to help those without test equipment that functions in the frequency range.

Next month, I plan to answer reader questions that have been

Continued on page 53

1152 MHz Board

VCO Freq MHz	1152							
Ref Freq MHz	1							
N	1152							
		R149	R148	R147	R146	R145	R144	R6
		M6 (pin 15)	M5 (pin 14)	M4 (pin 13)	M3 (pin 10)	M2 (pin 9)	M1 (pin 8)	M0 (pin 7)
M	114	1	1	1	0	0	1	0
Board as is		1	1	1	1	1	1	1
		A3 (pin 21)	A2 (pin 20)	A1 (pin 19)	A0 (pin 18)			
A	2	0	0	1	0			
Board as is		0	0	0	0			
		R3 (pin 5)	R2 (pin 4)	R1 (pin 3)	R0 (pin 2)			
R	9	1	0	0	1			
Board as is		0	0	0	0			
Pin 22	1							
Board as is	0							

Table 1. *Spreadsheet calculations ("3216 PLL Calculations," K. Banke N6IZW, 11/22/97) show original pinouts (board as is) and conversions needed for the "M", "A", and "R" counters, as well as the MODE pin 22. Additional instructions: Ground R150. Ground right side of R6–R150 as required. Remove U2, U4. Add 1000 pF at Q3 symbol. Power: J2-1, +15 V; J2-3, GND; J2-4, +5 V. Output: TP1. Remove FL2 to access 10 MHz ref freq adjust.*

Number 53 on your Feedback card

Hams with Class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

NASA activities

A great source of highly motivational lessons to use in a ham radio classroom or as part of a science curriculum is the Educational Division of NASA. Many of the lessons about the atmosphere are directly applicable to the lessons we teach to promote understanding about radio wave propagation. The whole approach used in their activity guides is one of investigative inquiry. It's really very well done and can be adjusted to various age groups in the classroom.

I'll share with you two of the lessons that have been used successfully by my 6th, 7th, and 8th grade radio classes at Intermediate School 72 in Staten Island NY. The lessons' theme is "The Mysterious Atmosphere."

What is the atmosphere? Scientists believe that millions of years ago our planet had a very thin atmosphere, which gradually became a protective blanket that maintained warmth and provided the necessary gases for life to evolve. Air bubbles in columns of ancient ice tell researchers that only 100,000 years ago—a brief moment in Earth's long history—our atmosphere was much different than it is now. Why has the atmosphere changed? How have changes in the atmosphere and weather affected life on Earth? Was weather related to the disappearance of giant dinosaurs? What is causing changes now? Will these changes have drastic effects? All of these are mysteries.

What do you know about the atmosphere? Wave your arm around quickly. Did you feel anything on or behind your hand? What you felt is air—our atmosphere. It surrounds us like an invisible ocean of gases and particles; it has no definite boundaries but extends outward from the surface of Earth for thousands of miles. Most of us think of the atmosphere as just air, but it works as part of an intricate system that includes the Sun, Earth's oceans, and land surfaces, each influencing the others. We know much about the atmospheric system, but some of the ways in which the atmosphere, the oceans, and the land interact and change are still mysteries. For this reason, scientists travel Earth and into space to search for answers.

Investigation 1

Here are some activities to help you discover important characteristics of the lower atmosphere. Does air have weight? Your guessed answer is called a hypothesis. Now you test that hypothesis with an experiment. You'll need two small latex balloons, two pieces of string (each 15 cm long), a 30.5-cm ruler, a sheet of notebook paper, and tape.

Procedure

Attach a balloon to each end of the ruler, being careful to use exactly the same lengths of string or tape to attach each balloon. Suspend the ruler on a string at approximately the 15-cm mark to create a balance. With tape, attach the top of the string to a wall at about eye level. Tape the notebook paper to the wall behind the ruler. Put a pencil mark on the paper above and below each end of the ruler to mark its beginning position. Remove one of the balloons and blow into it, inflating it as much as possible. Tie and reattach the balloon with the same piece of string. Gently pull the string suspending the ruler away from the wall, allowing the ruler to readjust. Carefully release the string and check the ruler's new position. Mark the paper with the pencil again. Questions: 1. Does the ruler still balance? 2. Does one balloon now weigh more than the other? 3. What does this tell you about air? 4. Was your hypothesis correct? When a number of different experiments give the same results, the hypothesis may be accepted as a theory.

Investigation 2

Here is another investigation that the kids really enjoy doing because it can be set up as a "hands-on" for everyone in the class. Earth's magnetic fields are not visible to the naked eye, but when particles moving toward Earth interact with gas in the upper atmosphere, the light produced is sometimes visible as auroras. These are also called northern and southern lights. You can get a general idea of the shape of the magnetosphere from this investigation.

Materials needed: about 0.05 g of iron filings (a pad of coarse steel wool can be cut into fine pieces to substitute for iron fil-

Continued on page 54

Above & Beyond

continued from page 52

piling up and describe various bits and pieces for microwave operation. The questions, mainly, are: If it's for microwave and it works on the frequency I want, do I need it? And what problems will it help me solve? Well, there you have it for this month. 73, Chuck WB6IGP.

Number 54 on your Feedback card

Carr's Corner

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Receiving loops & loop preamplifiers: part 2

As discussed in part 1 last month, the output signal levels produced by loop antennas are typically very low. The use of a tuning capacitor can increase the levels by 10 to 200 times, but even these levels are often below what is needed. To overcome this problem loop users often provide a preamplifier to boost signal before sending it to the antenna input terminals of the receiver. Before looking at specific designs, let's take a look at the various amplifier-loop configurations.

Amplifier-loop configurations

The basic amplifier configurations are single-ended and balanced. The single-ended amplifier has only one input terminal and ground. The signal is applied between the input and ground. The balanced amplifier, which includes both push-pull and differential amplifier designs, uses two inputs. The amplifier responds to the difference between the signal applied to the two inputs.

Fig. 1 shows the most basic single-ended amplifier and loop configuration. The loops in

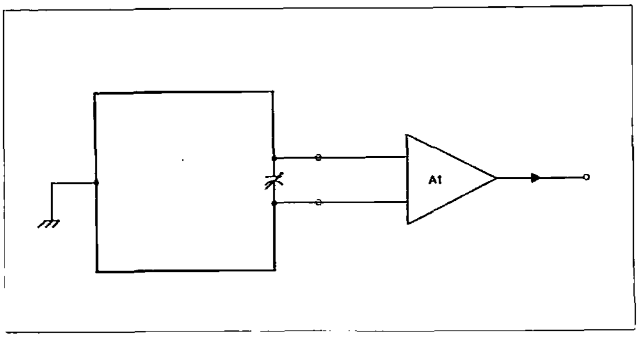


Fig. 1. Basic single-ended loop amplifier.

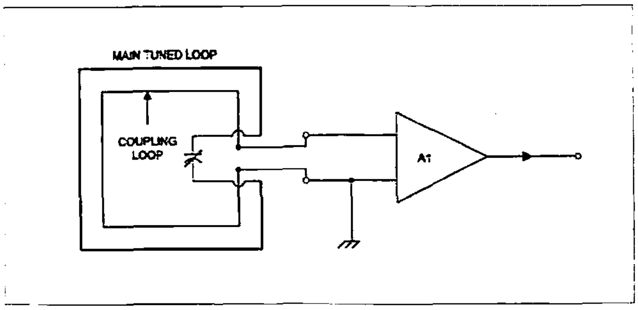


Fig. 2. Single-ended with coupling loop.

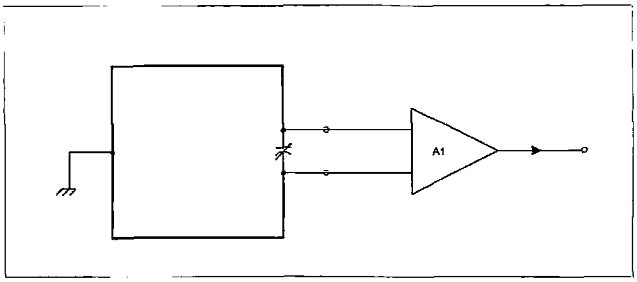


Fig. 3. Balanced loop.

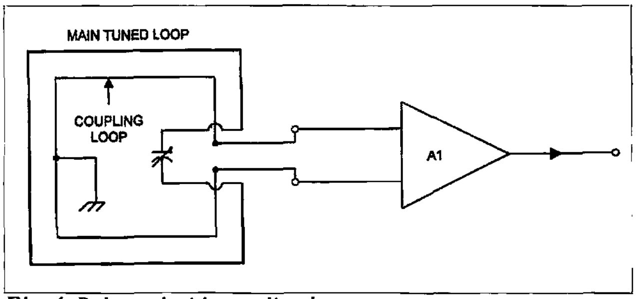


Fig. 4. Balanced with coupling loop.

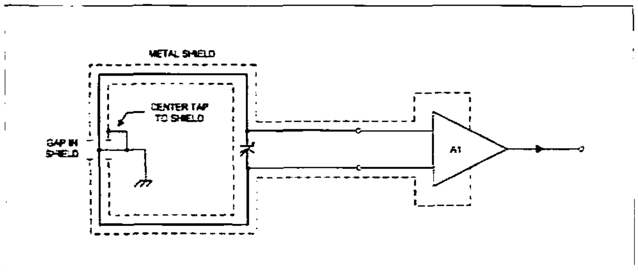


Fig. 5. Shielded.

Hams With Class

Continued from page 53

ings), heavy white construction paper, and a bar magnet.

Procedure

Measure the length of the magnet. On the paper, draw a circle with the same diameter as the length of the magnet. This will represent Earth. Mark the top of the circle "North" and the bottom "South." Lay the bar magnet on a flat surface such as a table. Place the paper over the magnet so that the ends of the magnet are on the "North" and "South" marks. Sprinkle the filings over the paper. Gently tap the paper, allowing the filings to move. Keep tapping until the pattern stops forming. 1. How can you tell where Earth's magnetic poles are? 2. What do the lines formed by the filings represent? 3. Look in an atlas to locate Earth's geographic poles. Are they in the same place as its magnetic poles?

A good place for an educator to get started with useful materials to use in the classroom is with CORE. This is NASA's Central Operation of Resources for Educators. CORE was established for the national and international distribution of NASA-produced educational materials in audiovisual format. The address is:

NASA CORE
Lorain County Joint
Vocational School
15181 Route 58 South
Oberlin OH 44074
Phone: (216) 774-1051 ext. 293

Let's all remember that sharing good instructional ideas is what the "Hams With Class" column is all about. Please send me any teacher-tested things you've had success with. Include photos and we'll highlight your children having fun with ham radio.

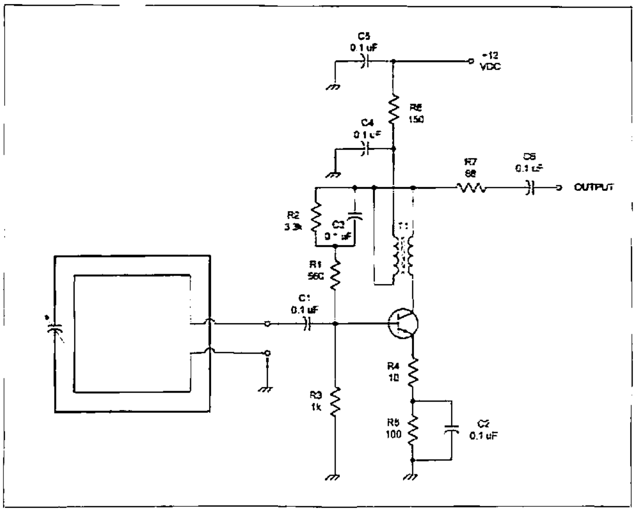


Fig. 6. Bipolar NPN transistor preamplifier.

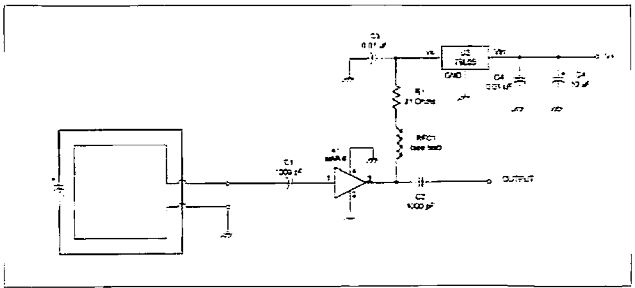


Fig. 7. MAR-6 preamplifier.

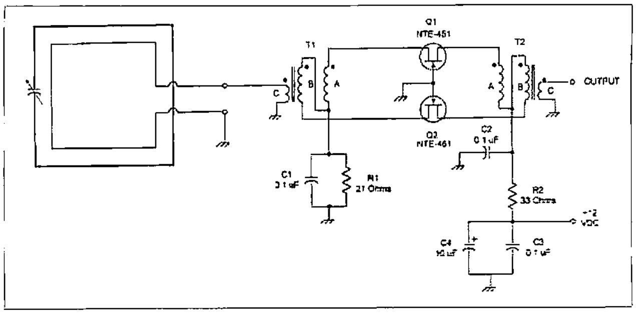


Fig. 8. Push-pull JFET preamplifier.

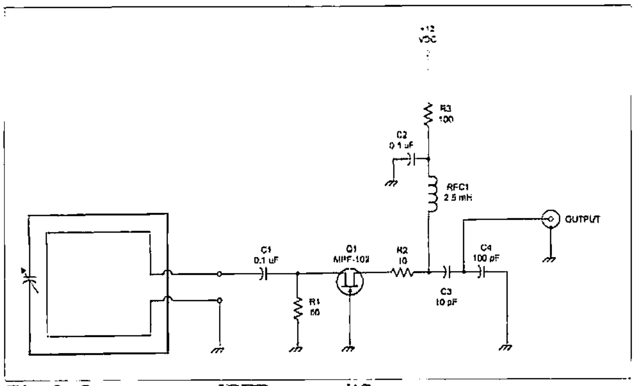


Fig. 9. Common gate JFET preamplifier.

Figs. 1–5 are shown as single-turn loops, but that is a graphical convenience, and both single-turn and multi-turn loops are intended. The loop is tuned by a capacitor. One end of the loop and the loop winding is grounded, as is one terminal of the amplifier input. A variant circuit is shown in **Fig. 2.** The version in **Fig. 1** uses the main loop to provide signal directly to amplifier A1, while the variant version of **Fig. 2** uses a coupling loop (magnetically coupled to the main loop) to provide signal to the amplifier. Both are single-ended, but in one case the main loop is used and in the other a coupling loop is used.

A balanced loop is shown in **Fig. 3.** This type of loop is center-tapped and the tap is grounded. This provides genuine balanced input for the differential preamplifier, A1. The same idea using a coupling loop is shown in **Fig. 4.**

Shielded loops are often used to eliminate pattern distortion due to capacitive coupling between the loop and its environment, and interference to reception due to local electrical fields. In **Fig. 5**, the loop, the tuning capacitor, and the amplifier input circuitry are Faraday-shielded by a metal barrier. A gap in the shield allows the loop to respond to the magnetic field component of the radio signals. If a center-tapped loop is used, then the center tap will be grounded either at the gap or close to the output (provided that it is electrically at the center of the loop). Tapping the loop at the output side is more convenient on multi-turn loops, while on single-turn loops the gap method is used.

Single-ended amplifiers

Fig. 6 shows the circuit for a simple preamplifier based on an NPN transistor connected in the common emitter configuration. The type 2N5719 is most often used in this circuit. Two negative feedback methods are employed in this circuit. One is an unbypassed portion of the emitter resistance (R4), and the other is transformer T1. The negative feedback serves the purpose of reducing distortion and smoothing the frequency response characteristic. This amplifier is normally used from 3 to 30 MHz, but with suitable selection of transformer and capacitors a different range can be accommodated.

The unique thing about this circuit is that it has a 50 ohm input impedance and a 50 ohm output impedance, and so will interface nicely with the coupling loop and the antenna input of the usual receiver antenna input.

Another single-ended amplifier is shown in **Fig. 7**. This circuit is based on the Mini-Circuits MAR-6™ integrated circuit amplifier. It is a low-noise amplifier that provides about 20 dB of gain over the frequency range of from near-DC to 1,000 MHz. Capacitors C1 and C2 are used to couple signal into and out of the amplifier, while blocking DC.

The DC power is applied to the MAR-6 integrated circuit through the output terminal. The DC path includes R1, which limits current, and RFC1, which peaks the gain at high frequencies. The DC source voltage is supplied through a low-power 78L05 100-mA, five-volt, three-terminal voltage regulator.

The RF choke (RFC1) is used as a peaking coil, and is optional in some applications. The usual practice is to provide a 1 µH inductor for this purpose. In higher frequency amplifiers (VHF and above), the RF choke might be replaced by a ferrite bead slipped over a short piece of #22 or #24 hookup wire.

The amplifier in **Fig. 8** uses a push-pull circuit to improve dynamic range and reduce distortion, but from the loop's point of view it is single-ended. The single-endedness is provided by the input transformer, T1. Windings "A" and "B" are used to drive the emitters of the JFET transistors (Q1 and Q2). Winding "C" is used to couple to the

Continued on page 56

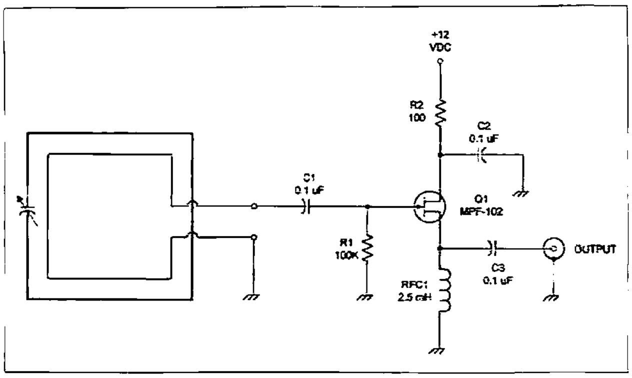


Fig. 10. Common source JFET preamplifier.

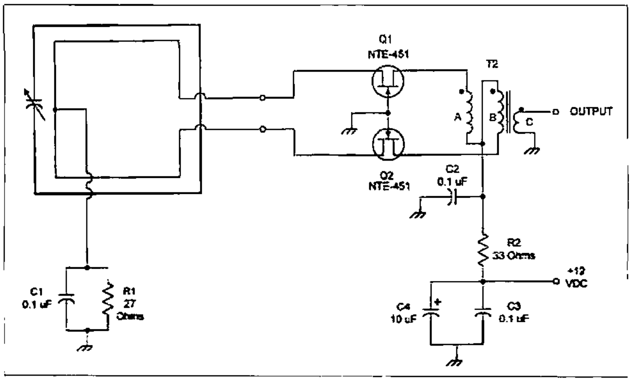


Fig. 11. Loop integrated push-pull preamplifier.

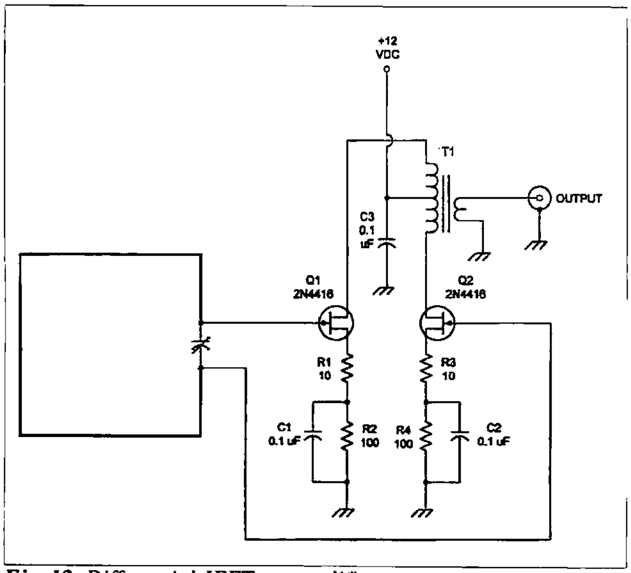


Fig. 12. Differential JFET preamplifier.

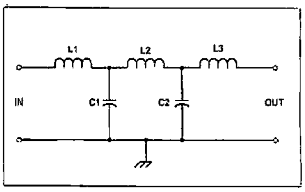


Fig. 13. Low-pass filter.

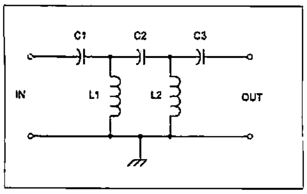


Fig. 14. High-pass filter.

Carr's Corner

continued from page 55

loop. If the coupling loop of the antenna is used (as shown), then winding "C" is a low-impedance winding. If, on the other hand, the main loop is used, then the impedance of winding "C" must be higher. Windings "A" and "B" must match approximately 1,000 ohms, while T2 must match 1,700 ohms.

The transistors used for the circuit of **Fig. 8** are either 2N4416 devices, or the service replacement equivalents NTE-451 and ECG-451.

A slightly different design approach is used in **Fig. 9**. The amplifier device is an MPF-102 JFET device connected in a common gate configuration. Signal is applied across the source-gate terminals, while output signal is taken across the drain-gate terminals. Because this circuit is inherently low impedance, it is used with the coupling loop approach to antenna design.

Capacitor C1 is used to block DC bias, provided by the voltage drop across R1, from being shorted to ground through the loop. The output circuit consists of a capacitor voltage divider, C3/C4. This circuit matches the relatively high impedance of the Q1 drain to the 50 ohm antenna input used by most receivers.

Another JFET preamplifier is shown in **Fig. 10**. This circuit uses the same device (MPF-102) as the previous circuit, but in the common drain configuration. The signal is applied across the gate-drain terminals, while the output signal is taken from the drain-source terminals. The source circuit, which is ~~used as the output,~~ has a series-connected RF choke. This part keeps the source terminal at a high impedance for RF while allowing it to complete the circuit for DC.

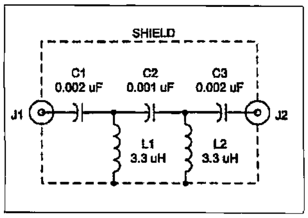


Fig. 15. Compromise.

Balanced amplifiers

An example of a balanced amplifier is shown in **Fig. 11**. This circuit is a variant on the theme of the **Fig. 8** circuit in which the input transformer (T1 in **Fig. 8**) is replaced by the loop. Because the circuit is a common gate push-pull amplifier, the coupling loop must be center-tapped in order to provide balanced (but out of phase) input signals to Q1/Q2. As with the previous version, the DC is applied to the drain terminals of Q1 and Q2 through the windings of output transformer T2.

A common-source differential amplifier is shown in **Fig. 12**. The active devices, Q1 and Q2, are 2N4416 JFET transistors. Source bias is provided by resistors R1/R2 for Q1 and R3/R4 for Q2. A small amount of negative (degenerative) feedback is provided by unbypassed source resistors R1 and R3.

The output side of the circuit uses a push-pull transformer (T1). Such transformers are center-tapped. The DC power is applied to the center tap, and then routed to Q1 and Q2 through the windings of the transformer. Because of the center-tapped loop, and center-tapped output transformer, Q1 and Q2 operate out of phase with each other.

Input filtering

One of the more difficult to solve problems in radio receivers is overload from out of band signals. The frequencies that are most often used with loop antennas are often subject to strong overload from AM broadcast band stations, local amateur radio stations, and other transmitters. These signals can cause problems in the receiver even if they are not heard in the output, and thus need to be eliminated. When a preamplifier is used between the receiver and antenna, the problem is only made worse.

Continued on page 57

Number 57 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[PanGen@compuserve.com]

Sometimes people wonder if your ideas and suggestions are noticed. Trust me, your thoughts are the best inspiration. For example, I received an E-mail message from Walter K5KNE, who offered some real food for thought about emergency communications. He pointed out that many hams are interested in being of service in an emergency, but are not affiliated with any public service or other emergency agency. They expect to show up when an emergency occurs and be of assistance. As Walter put it, "The average well-intentioned ham doesn't realize that he is just another sightseer with a radio—unless he has a 'real job' with a responding agency." I've been thinking about his comment for the past few weeks as much of the nation has been facing *El Niño* weather problems. In my area SkyWarn has been activated a number of times as rain and high winds have led to flooding and several tornadoes.

Our SkyWarn system works pretty well, with one ham acting as net control, while another works with the weather bureau, and the majority act as spotters spread throughout the county. As the meteorologists at the National Weather Service become aware of developments or see a suspicious radar image, they may ask if anyone in that area can actually see and accurately describe the conditions. The SkyWarn weather spotters are one more data point the weather experts use to make a forecast. If a watch (conditions which are conducive to developing into a particular type of storm) or a warning (the storm, such as a tornado, has actually been observed) is declared, that information is then released to the public through local radio and television stations.

In many cases, though, well-meaning hams *do* act as sightseers with radios. There are the inevitable fair weather reports, or a report to the net that a television station is broadcasting a particular forecast. As amateurs we know that a signal can be lost if the noise level rises; much of what is being transmitted is noise and nothing more. What this says to me is that these folks desperately want to be involved in order to help out, but they don't have a specific function assigned. In their attempt to help out they are at significant risk of making matters worse. Imagine if our firefighters or police officers responded with the proper equipment, the best of intentions but no clear understanding of precisely what they needed to do or to whom they would report. As the old saying goes, "If you're not part of the solution, you're part of the problem."

The key is to know exactly what you're expected to do, for whom, well in advance of the emergency situation. Area coordinators for disaster services need to prepare with this perspective rather than assume that people will be identified, located, assigned and trained in the moments after a disaster hits. Individual hams need to find out what roles they can expect to play. Since there are so many, a well-informed ham can review the possible assignments, and then apply or lobby for one of those which looks interesting.

How do you determine what is available? Obviously, experience is the best teacher, or you can talk with someone who has been involved in emergency communications for a number of incidents. To get a more global perspective you can turn to a number of books addressing disaster communications which have been published in the past few years.

Among those that are general in nature, *Guide to Emergency Survival Communications*, by Dave Ingram (Universal Electronics), is a fun book to read. It is aimed at those who want to "receive accurate and timely information in time of crisis." These are non-hams and potential hams, but the book reminds us of how many people will be listening in on our efforts to support an emergency. The preface details how Murphy's law is paramount in disaster communications.

When the Big One Hits ..., by Jerry Boyd KG6LF and Jay Boyd KN6BP (World Radio Books) is more amateur radio-oriented and addresses specific types of disasters. It gives straightforward guidance to

Continued on page 58

Carr's Corner

continued from page 56

The usual (and most effective) method for eliminating these problems is to put a filter either ahead of the preamplifier or between the preamplifier and receiver antenna terminals. Even if no preamplifier is used, if a problem is experienced then the filter can be used between the antenna and the receiver.

Figs. 13 and **14** show the low-pass and high-pass filter circuits, respectively. The low-pass filter passes frequencies below its -3 dB cut-off frequency. Such filters might be used on an LF or VLF receiver to prevent overload from AM BCB stations. In Europe, where both the medium wave (0.520–1.710 MHz) and LF band (145–280 kHz) are used for AM broadcasting, the problem is especially severe. Such cases may require two filters.

These filters are designed for 50-ohm input and output impedances, which is the standard impedance for most RF systems. The values for the components in **Figs. 13** and **14** are found by dividing the following constants by the desired cut-off frequency in megahertz (MHz). For the low-pass filter (**Fig. 13**): L1 constant = 5.6; L2 = 10.6; L3 = 5.6; C1 = 3300; C2 = 3300. For the high-pass filter (**Fig. 14**): L1 constant = 5.36; L2 = 5.36; C1 = 3900; C2 = 1800; C3 = 3900.

For example, suppose we want to design a high-pass filter to prevent AM BCB signals from overloading a medium wave shortwave receiver (3 to 7 MHz). We might select a -3 dB cut-off frequency of, say, 2 MHz. The component values for the high-pass filter then would be:

C1 = 3,900/2 = 1,950 pF
C2 = 1,800/2 = 900 pF
C3 = 3,900/2 = 1,950 pF
L1 = 5.36/2 = 2.68 µH
L2 = 5.36/2 = 2.68 µH

A slight variation on the theme is shown in **Fig. 15.** This circuit is a "practical" compromise that allows the use of standard value components. The capacitors are 0.001 µF and 0.002 µF units, both of which are standards. The 0.002 µF capacitor can be made by paralleling two 0.001 µF units, if desired. The 3.3 µH values for the coils are a standard value. Although they can be made from toroid core and a bit of wire, these coils can also be purchased from Toko™ dealers and other sources.

Number 58 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Avenue SW
North Lawrence OH 44666
[prosolar@sssnet.com]

As the sun warms the planet this time of year, spring arrives and once again the earth is renewed. It's also the time of year that marks the beginning of hamfest season! And of course the biggie that starts the season off is Dayton's hamvention®. With luck, this year will mark my 24th trip to Dayton. And if my timing is correct, the column should hit just as the hamvention kicks off.

Dayton is a place to spend money. It's as simple as that. I know I save all year long just so I can spend my money on something I really don't need. So, having said that, let's look at some of the QRP rigs and some price guidelines.

A word of caution may be in order. I've gathered these prices from hamfests I've been to in the past as well as from classified ads and CompuServe's HamNET forum. They're not carved in stone, but are meant to serve as a guide in your purchases. These prices may save you some money or if you're the one doing the selling, make you some money.

It's also a sure bet that the hamfest sellers have increased their prices, knowing the buyers will haggle them down. It's all a game—and if it's played correctly, both parties come away happy.

Know your abilities

If you're looking for a radio, are you able to repair it, if it's broken? Some of my best deals came from buying rigs from the hurt locker. My absolute best deal ever was an Argonaut 509 for $15.00 (of course, when I picked the rig up, parts fell out of the case). Even if you can fix the rig, are replacement parts available? If so, are they expensive? Some of the classic QRP rigs are hitting 25+ years old. Many of the cosmetic parts are no longer available at any price.

If you can't fix it yourself, you'll have to *pay* someone who will. Keep that in mind when you're out looking for rigs.

How about manuals? Lost or missing manuals will be a gotta-have if the rig is kaput. I've been told that the prices of some manuals from Heathkit are very, very expensive (try $50 for an HW-99 manual). If the rig you're after has all the manuals, you'll pay for them, as the price is usually part of the overall deal. On the other hand, if the manual is missing, this might give you some leverage when haggling.

Dead ham rigs

By buying from an estate sale, you're getting someone else's gear without the benefit of knowing anything about its history. Such questions as "Does it work?" or "When was the last time it was on the air?" are important—but there's usually no one available who can answer these questions. Some of the stuff may have been sitting for years in storage since the old guy died in 1978, and his wife died last year—so it's possible the HW-7 has been sitting untouched for 20 years.

Everyone wants a bargain but buying from an estate can be a bit tricky. Most widows want the maximum bucks from the old man's stuff. Most will quote a selling price as the same as the purchased price when new—27 years ago! On the other side of the coin, the people standing on the opposite side of the table will offer the widow pennies on the dollar.

If you're the one selling and have no idea what the stuff is worth, get hold of someone who *does* and price the gear accordingly. If you're doing the buying, offer reasonable prices for the stuff.

Heathkits

Since we talked about Heathkit rigs several months back, it seemed fitting to start here.

Heathkit made three QRP rigs: the HW-7, HW-8, and the HW-9. The HW-7 and HW-8 sport direct conversion receivers. The HW-9 has a superhet receiver and would (provided the WARC band kit was installed) cover the WARC bands.

You can pay anywhere from next to nothing for an HW-7 in good shape to about $125. Because the receiver in the HW-7 sucked, mostly collectors seek out this rig. If the guy on the other side of the table has a mint HW-7 and knows he does, I've seen asking prices of over $225 for one.

The HW-8, on the other hand, is still quite sought-after and there are thousands of them working the lower end of 20 meters. Expect to spend from $80 to about $150. The only option the HW-8 had was a small power supply. Figure about $10 to $25 more if the supply is included.

The HW-9, on the other hand, seems to demand a rather high price. There were several options for this rig, including the WARC band kit, a wattmeter and an antenna tuner. An HW-9, with the WARC band kit, around $175 to $250. Options will of course drive up the price. A lot of HW-9s had dial slippage problems as well as stability

On the Go

continued from page 57

various aspects of emergency communications, including an analysis of various disasters and how hams could be involved.

The book that I keep in my emergency bag is *ARES Field Resource Manual* (ARRL). This book is useful because it has forms which you complete with frequencies, telephone numbers, names, etc. In this way it can be a training manual as well as a reference manual in the field. I replace my copy periodically because it will get dog-eared and stained through use. It is definitely the most specific book I've seen, since you fill in the blanks after you buy it, which is also helpful in identifying possible duties.

After looking at the options, decide where you wish to work in an emergency. You could be with the Red Cross damage assessment team, or at an emergency shelter. Does your city or county have people assigned to the police and fire department communications services? What about working with the folks who provide food for the rescue teams? Will the local hospital need additional communications support? Doesn't it make more sense to choose what you want to do, train to do it and get to know your potential co-workers well in advance? Even if you are the rare individual who can do it all, some jobs are going to be better than others. Wouldn't you prefer to have some choice in the matter rather than be assigned whatever is left over?

Emergency communications is a skill that must be properly learned and properly practiced. This is why it is important to have a good overview of how disasters are managed, and more important to know precisely what you will be called upon to do and for whom. When an emergency hits and you report to your agency, the response should be, "Thank goodness you're here," not "Who the heck are you?" Be an asset rather than a sightseer with a radio. 73

problems on 10 meters. Ask the seller if this rig had those faults.

Ten-Tec

Ten-Tec got their start by selling QRP modules. They have a widely varied selection to choose from—the PowerMite series have become classics. The PM1 and PM2 are sought out, not so much as operating rigs, but as collector items. A clean PM2a can fetch upwards of $200. But many hams who own a PM2 don't know its real value. As of last year at Dayton, two were sold at the Day's Inn™ for $35 each!

Ten-Tec also sold a receiver-only rig known as the RX10. While perhaps not exactly QRP, demand has made them expensive. Expect upwards of $400 for an RX10. Ten-Tec also made a matching transmitter for use with the RX10. I've only seen one of these in my many years of hamfests. If I recall, the Ten-Tec designation was the TX10.

The Argonaut

Clearly these rigs by Ten-Tec are in demand today both by the collector and rag-chewer.

The Ten-Tec 505 was the first in the series. As with all the Argonauts, the 505 supports CW and SSB. A 505 in good shape sitting on a table in a flea market can fetch from $125 to $200.

By far the most popular of the Argonauts is the 509. Several fixes from the 505, the 509 is still on the air today. Plan on shelling out between $175 and $300 for one.

The last of the Argonauts, the 515 is a rare find today. Plan on spending $300 to $450 for a 515 in mint condition.

OK, I lied. The last of the last of the Argonauts, the Argonaut II, is very rare. Plan on spending about $800 for one. If you see a Delta II, that's the same thing as the Argonaut II, with a 100-watt PA stuck on the rear end.

With the exception of the Argonaut II, there was a handful of accessories for the Argonaut family. The most common accessories were the audio filter and crystal calibrator. There was also a small antenna tuner as well. If these are included in the sale, take note, as they are very hard to come by. You won't see them sitting all by themselves in the flea market.

The 405 amplifier shows up every now and then. Expect to spend about $150 to $225 for the unit. The high end I just quoted is more than the amplifier sold for, new. There was also a power supply that was required to power the 405 amplifier. If the supply is included with the amplifier, adjust your pricing accordingly.

Although not exactly in the QRP class, the Ten-Tec Century 21 and Century 22 are used by many QRP operators.

The original Century 21 with the analog dial should go for $125 to $175. The digital version of the Century 21 will fetch $150 to $175. The power supply is internal to the Century 21. There were two options: the audio filter and the crystal calibrator.

The Century 22 is a rather rare find at a hamfest. Sporting an Argosy-like appearance, the Century 22 will set you back about $250 to $325. A calibrator and keyer were options. The Century 22 did not have an internal power supply.

Completing our list of Ten-Tec equipment are the Argosy I and Argosy II. The Argosy is one rig that I have kept through all these years. It's the one they will have to pry from my cold dead fingers when I kick off. An Argosy I in good condition will go from $250 to $325. Plan on spending from $325 to $400 on an Argosy II.

There was a slew of options available for both rigs. These options ranged from a crystal calibrator to a noise blanker. There were optional crystal filters along with an audio filter, too. The power supply was also an option. If you plan on running an Argosy portable with battery power, you will need the magnetic circuit breaker. I've been told that Ten-Tec no longer carries this breaker. When dickering over the price of any of the Argosy rigs, keep in mind the options (or lack thereof) offered in the deal. Those crystal filters alone went for over $50 each!

Odds and ends

There are two more rigs you may be looking for—the MFJ QRP series and the Yaesu FT-7. The MFJ rigs have been out there long enough that some are starting to show up on the used market. Although monoband, they're a lot of fun to use. Right offhand, about $80 to $100 is the going rate for one. Again, depending on whether the optional keyer and/or the audio filter is included. At Dayton, with a zillion dealers selling MFJ equipment you should be able to find a *new* MFJ QRP rig for $125.

Yaesu made a mobile QRP rig called the FT-7. Although a bit high-powered for a dyed-in-the-wool QRPer, they are popular. Designed mainly for mobile use, the analog dial is kinda hard to see. The FT-7 works both SSB and CW. An FT-7 will go for about $225 to $300. A bit more money ($275 to $400) buys you an FT-7A.

Well, that's my QRPer's wish list price guide for the Dayton hamvention. The flea market covers acres—wear your best old shoes and have fun. Stop by flea market spots 509, 510 and 511 for the finest in solar equipment or to just say hello! 73

Number 60 on your Feedback card

THE DIGITAL PORT

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

Serial modems and software just get easier and less expensive as some good-hearted hams contribute. You readers keep me hopping with word of products and procedures that make the world of digital hamming more fun all the time. I appreciate that. I counted at least seven individuals and organizations who are making a difference to the benefit of ham radio as I was writing this piece. Keep it up.

I goof now and then ...

Along the way. I also receive E-mail and letters about some of my goofs. One of the recent errors I must admit to was typing the incorrect URL for Terry Mayhan's Web site. *K7SZL's Unofficial HamComm Home Page*, where you can find all you need to know to construct your own HF serial modem. I left out one letter. and sure enough. alert readers let me know about it. quickly.

What did I learn? Not just to be more careful; I was being as careful as my squinty little eyes would allow. I developed a better technique and I will pass it along. I use Netscape software and when I bring up a Web site now. I click on the displayed URL which "selects" it, then press Control+C to copy the URL to the clipboard. This is what happens when I did that with the above-mentioned Web site and then pasted [http://www.accessone.com/~tmayhan/index.htm]. I am sure some of you alert readers have already discovered this. but I have only been doing it religiously since the incident I referred to. It also works well as I refer to Web sites in E-mail. That way I am sure a current working address is going to the recipient.

Sometimes, it just takes patience

Frequently, I get requests for the correct URL for PCFlexNet. There is no error in the address as reported here. The problems usually stem from the fact that something goes awry in the European Internet system. I have experienced this as well as have others I talk to. As long as the address is entered properly. the solution is to wait several hours or a day and try again. Magic things happen. Refer to **Table 1** for URLs.

There were several more things I learned when I received a request from Dave WA4GVT. Dave asked for assistance to get the information on the HF serial modem described in the above K7SZL's Web page as he did not have Web access.

New stuff

That was not too difficult. I brought up the Web page to make a fresh copy because I had scribbled on mine. and was glad I did. It seems Terry is enhancing his modem and the improvements are well defined in his displayed circuit and accompanying text. So. that is another project to follow up on if I am truly making the effort to keep abreast. I also downloaded. per request. appropriate shareware and sent it along to Dave.

Surprise in the mail

This didn't seem like a terrible burden. but there was another lesson to be learned. A few weeks ago. I received a package from Dave with a kit from LDG Electronics to build a 1200b packet modem as described in *73*'s February 1996 issue. The lesson? Hams don't let good turns go unnoticed.

At this writing. I have assembled the kit. but have not quite got it debugged. It copies the received signals and transmits. but the transmitted signal isn't correct. I contacted Dwayne at LDG and he sent additional info that should help get this modem going in the right direction. This will make a nice little board that I can combine into a box with my HF modem for portability. (Hams always have a dream. and their wives never know why.)

If the wife were looking over my shoulder just now and could see that there is also a perfectly good working model of the original BayCom 1200b modem in the shack. she would sagely advise that I "let well enough alone." This is good advice. but a digitally-challenged ham (interpret as you will) must be ready to try each new idea as it comes.

The BayCom modem arrived as a result of my quest for parts to build a replica of this little wonder. I checked with various suppliers and was not faring well with the TCM3105 chip. I asked George SV2AGW if he would check with his friends. as I knew they were deeply involved with modems. He advised me of some alternative chips but they did not appear readily available. so what did George do?

Rescued

He located a working BayCom modem and made it possible for me to obtain it for the shack. This is not to say there is some endless supply of modems stockpiled on a Greek island. That may have been the only one. This now gives me a standard by which to judge other modems and software. I must sincerely express my appreciation for the kind efforts of George.

Source For:	Web Address (URL):
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexNet communications free programs	http://dl0td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexNet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom — German site	http://www.baycom.de/
VHF packet serial modem kit	http://www.ldgelectronics.com

***Table 1.** Current Web addresses as of this writing as mentioned in the text. There are more and I will add to this group and post it frequently. All of the above were cut-and-pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later.*

The first thing I had to do to put the BayCom into service was make a cable to my ICOM 2AT radio. The information with the modem showed there was no PTT line. This seemed a little strange so I took a look at the BayCom Web pages and found the radio jack described for the display model on the Web site was different and included a PTT line.

Just plug it in

After a little thought, it seemed logical that if there was no PTT line, then a keying circuit must be included in the hardware as it came. George had said something about advising me if I needed a PTT. Anyway, I made up a cable with just the three lines available, transmit, receive and ground, hooked it up and it played beautifully.

The first software I used was the BayCom DOS software because I knew it always worked. It is a good package once you cause your mind to follow the proper patterns. I think it will do about anything I could ask, but I wanted to try something that had not worked with my previous go-round with a packet serial modem.

I wanted to see this modem work with a Windows 95™ program. What better than to test the "new and improved" SV2AGW Packet Engine and accompanying Terminal program. I went to the Web site, [http://www.forthnet.gr/sv2agw/], and downloaded the files dated Jan. 28, 1998. I understand new revisions are shortly forthcoming and will be available before this is published.

The updated programs really perform. There is not a lot of configuring because the software does it all, and since there is no TNC with built-in parameters to change, you only need a few minutes to be sure the software is looking out the proper serial port and you have your call inserted. (Packet just won't connect, regardless of the system you use, unless your call is in the software or, in the case of a TNC, in the hardware memory.)

Incidentally, George claims I could run my PK232 or other TNC at the same time as the serial modem with his software. It is not only flexible to drive other than a serial modem but can be open to 100 simultaneous connections. Very versatile.

While I was checking the parameters one of the screens started displaying the activity on the monitor. Looking good! I pulled down menus until I found the one with "connect" in it and clicked on it. I entered the local call, "CCBBS," clicked the box to connect, and it did the job. Best ever with a serial modem and Windows 95 combo! See **Fig. 1**.

And it's all free!

George really did a great job and he admits he has more to add. He is an example of hams going the extra mile. George writes these programs, puts them on his Web site and leaves them there as freeware. That is a lot of work in anybody's books to just give away and expect nothing in return.

I did notice one problem that George admits he must repair. Somewhere, during his updates, the ability to print went away. It is a small problem. I found I could work around it by saving the contents of the screen to a file and then opening it with the word processor. From there it was a snap to print. Most of us have little reason to print packet messages but we do it once in a while and there is a way even though this Windows program has lost that function for a time.

I gave a wrong description

During communications with George, he informed me that I had described one of his other programs incorrectly. Another goof. On his Web site, he has a program, AGWBBS that I did not previously download and assumed it was a program to

Continued on page 62

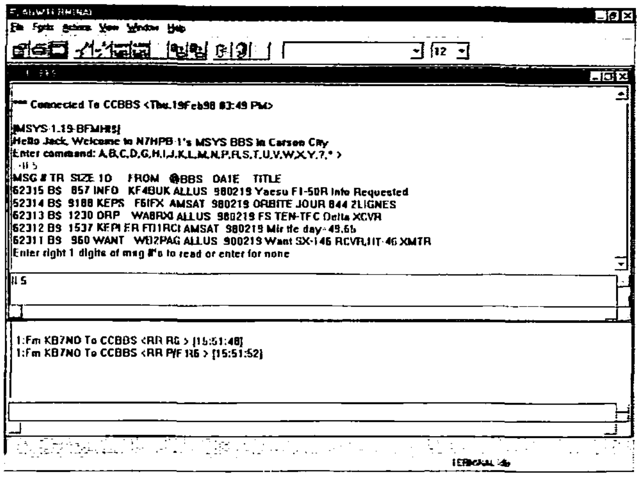


Fig. 1. The latest SV2AGW terminal program in action on the laptop using the BayCom modem. The upper screen displays the information from the local PBBS that we want to read. The lower screen shows the background activity that takes place between my station and the bulletin board. It is not necessary to display this screen, but it is available for you to check when the connection seems to be going awry. You manage this from the Windows™ menu.

Number 62 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can protect our ham radio stations from the effects of a lightning strike. So far in this series (which began with the January 1998 issue), they have covered some interesting lightning statistics; antenna location; the importance of a single-point ground system and how to install an effective underground radial system to disperse the energy in a strike safely; what shape and size ground conductors are best to use; soil doping; ground resistance measurement; how to handle dissimilar metals; how to minimize pickup of radiated energy from a lighting strike; how to protect your coax and rotor control cabling; and some tips on protecting utility lines entering and exiting your ham shack (and home). Part 4 of the series was presented last month; part 5 now follows.

Lightning protection—what your mother never told you!—Part 5

When dealing with grounding systems for lightning protection, be sure to route all ground straps and grounding conductors to form a gentle bending radius. Bends sharper than a one-inch radius will add unwanted inductance to the desired ground path. Sharp bends should not be used even for conductors that are buried underground.

Coaxial protectors should have DC blocking on the center pin, i.e., they should show an "open" to DC current (such as when measured with a typical ohmmeter). This serves as a form of high-pass filtering, which prevents the DC, and the low-frequency energy of lightning, from continuing on toward the equipment. The strike energy is diverted into the ground system instead, in a controlled, predetermined fashion. This DC blocking also ensures the operation of the protector regardless of the input circuitry of the equipment being protected. Since lightning is mostly of the same polarity, protectors (or even RF equipment with ferrite core material inductors to ground) will carry enough surge current from a strike to saturate those cores. Over time, the ferrite material will therefore become "oriented" and will no longer be random. This is the primary reason why isolators often have less directivity over time, and become lossy. Protectors using ferrite coils prior to voltage crowbar gas tubes will also experience a VSWR degradation with repeated hits.

Protectors with DC continuity will not work on receivers and shunt-fed duplexers. The shunt-to-ground inside a receiver (the input coil to ground for static draining) prevents the low-frequency lightning from being conducted safely to ground by a protector having DC continuity. Here's what happens: The coil in the receiver shunts the energy to ground, but at the wrong place. If the coil cannot handle the energy (half the coax surge energy is on the center pin), the coil will open, and the current will translate to a large open voltage source capable of arcing anywhere within the radio. The best protectors DC-block both the center pin energy, and the shield energy, from the equipment, thus preventing shield energy from continuing to the equipment chassis. If the "withstand" voltage (shield protector turn-on level) is exceeded during a strike

THE DIGITAL PORT

continued from page 61

operate a packet BBS. I stated that as a fact a few months back.

The program is really an automated access program to access your local PBBS, list bulletin headers as you classify, plus automatically retrieve your mail and send your outgoing mail. I downloaded the program, installed it, and it works. I didn't spend a lot of time with it because my local packet activity is really limited compared to folks in the big city.

Previously I have mentioned that I am located in a valley that severely limits access to line-of-sight radios such as those used for packet. Even though the city is getting bigger, that one aspect never changes. Until they level the hills around here, there is a certain peaceful isolation that remains.

Remains from when? Thirty-five years ago, you could wake up to the sounds of cows in the nearby pasture. Actually, even today there is still a half-mile marked off as open range inside what is now a residential area. That means if you run down a stray cow on the street, you pay the owner the value of the cow. It had the right of way and you were trespassing. Seems strange in a town that has grown from 5,000 to 50,000 inhabitants in 40 years.

That population explosion is, of course, referred to as *progress*—the boon for developers and the bane for the erector of antennas. Carson City now has ordinances just like the big cities. Fortunately, I have had antennas in place for a number of years.

This little aside wasn't meant to wander far. I was merely setting the stage for the fact that it is difficult for me to comprehend the intensity of packet usage where traffic is going and coming from a packet BBS all day long and how frequent access would yield continuous cutting-edge information.

That is what the AGWBBS program can afford for the many of you who are located next to highly active ham PBBSs. What is different here is that the local PBBS uploads and downloads its changed content from a parent PBBS around the mountain once a day and that is the activity. The rest of the time we can dodge the cows on the city streets.

SSTV program for serial modem

Another bit of education came in the mail a week or so ago and I have only had time to give it a cursory inspection. John WB2OSZ sent me a copy of *Pasokon*™ *TV Lite* to work SSTV with a serial modem. I loaded it into the laptop and it is a beautiful program. The complexity must equal that of a Windows program, judging by the functions available and the time it took to install itself.

There is an annoying problem with the IBM ThinkPad™. They do not have the mouse working in DOS and this DOS program really must have a mouse to make it perform. I will either get a DOS mouse driver into the laptop or load the program into the desktop and let you know how it works next month.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line at [KB7NO@N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

event, and if a proper single point grounding system is in place, the voltage on the shield to the equipment will not exceed 10 kV.

Ham shack location and protection

A basement is an ideal location for a ham shack. It's close to ground and generally has the lowest inductance run to the exterior grounding system. Because it's below grade, magnetic shielding may also occur naturally. Most basements, however, have concrete floors, and since concrete is considered a conductor, the equipment must not sit directly on the concrete floor. In the event of a strike, surge energy could enter the shack and seek out a ground path through the equipment and to the floor. Insulate the equipment with a material that does not absorb water (a material that won't become hydroscopic from water or even moisture in the air). Polypropylene is a good choice for a full-footprint sheet insulator.

The first floor of a building is the next best location for your ham shack location. Just remember that magnetic shielding may be less, and the inductance to the ground system may be higher (due to a longer ground strap run). If the tower is located very close to the building, the recommended grounding strap (running from the exit point and down the building's outside) may itself inductively pick up some energy from the tower. This is also true for the coaxial cables, cabling for any tower lights and rotor lines. The longer the parallel run with respect to the tower, the more energy will be coupled. Protect these lines at the tower base with an EMT steel conduit. The conduit should be grounded to the equipment ground end only, and will act as a Faraday shield for the cables inside it. If the tower is somewhat farther from the building, it will be necessary to provide protection at the tower, for all lines, as well as have protection inside the shack itself. In this case, ground the conduit to the tower end only. Do not run any unprotected lines in the EMT. Protectors must be grounded to each other and to the tower ground. Place the protectors inside a weatherized NEMA (National Electrical Manufacturers Association) approved box, such as a NEMA 3R or NEMA 4X. Make sure the weatherized box and inside mounting plate are properly grounded (removing the paint from the box's outside and inside surfaces at the ground point) and use the correct joint compounds to weatherize all connections. Stainless steel hardware is also an option. All connection lugs must be crimped, soldered and weatherized. Remember, standard 60/40 solder will not hold up without protection when exposed to sunlight and ozone. If possible, try to use 96% tin and 4% silver solder; it has more strength and will handle high-surge currents, because it's specifically a high-temperature formulation. Use a short section of strap or a husky pigtail to bond between the inside surface of the NEMA box and the inside protector mounting panel. Ground any conduits at the ground level. Again, use the proper joint compound prior to either a vertical run or an entry into the building. Good mechanical and electrical connections don't just happen—they're based on experience and planning.

Roger and Ron Block's series will return again next month with more of what Mom never told you on how you can best protect yourself, and your station, from the destructive effects of lightning. This ongoing series in the "Ham To Ham" column this year is "must" reading for everyone who spends any time stretching conductors in the sky (and in the ground) in pursuit of that elusive rare one.

A "T" for top band

From Tom Hart AD1B: "One of the more popular wire antennas for the HF bands has been the venerable G5RV dipole, a classic antenna that operates well from 80 through 10 meters in its normal configuration. I've been using the G5RV myself for a number of years, all the way up to six meters, and have logged nearly 2,000 contacts with it on the RS-12 satellite to boot!

"On 160 meters, however, the G5RV (being horizontal) generally produces rather poor results, since most of us can't get a dipole style of antenna up in the air nearly high enough to obtain a good horizontal launch angle at 160 meters—most of the signal ends up going straight up! Even at 40 feet up, a horizontal dipole at top band (160 m) is only .08 wavelength above the ground, which would be functionally equivalent to putting your 10-meter dipole just three feet off the ground! Successful 160-meter operation, therefore, generally involves using a vertically polarized antenna, but unless it uses a large and lossy loading coil, it too will be extraordinarily tall—150 feet or better!

"Wanting to operate some 160-meter contests and other occasional get-togethers, I decided to try some simple (and easily removable) modifications to my own G5RV ... and a top-loaded 'T' configuration is what I found the easiest to implement. Additionally, it does a reasonably

Continued on page 70

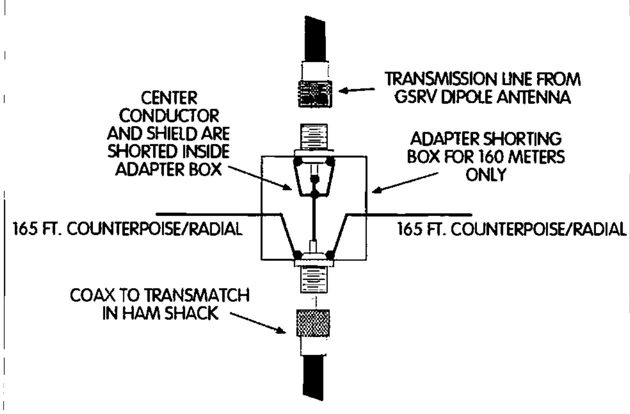


Fig. 1. Details of the adapter shorting box and counterpoise/radial hookup used at the base of AD1B's G5RV dipole antenna to permit him to temporarily utilize the antenna on 160 meters as a top-loaded vertical.

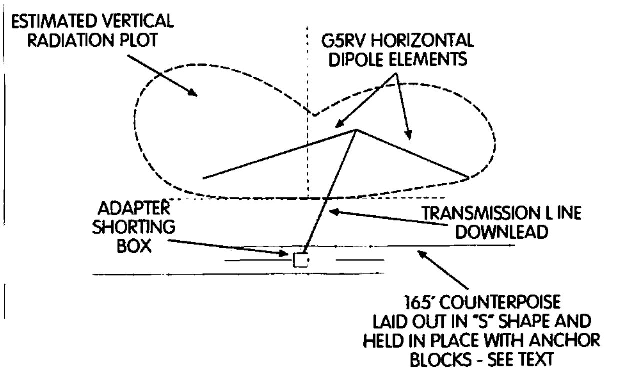


Fig. 2. AD1B's modification to the popular G5RV HF dipole antenna to permit contest weekend operation on 160 meters.

Ham Radio Fun

Home-brewing, Italian Style!

A two-element phased beam for ARDF.

Francesco Lancellotta IK8VWA
via B. Corenzio, 10
84129 Salerno
Italy
Packet:
[IK8VWA@IK8SUT.ICAM.ITA.EU]
E-mail: [ik8vwa@hotmail.com]

I'd like to share with you the antenna I built to take part in the "Town of Salerno, Italy" ARDF challenge, my first experience in this kind of amateur radio activity. Thanks to my homemade beam, I've reached the fourth absolute place, 26 seconds after third (not bad, eh?). Believe it or not, the total cost was about six dollars (US).

Photo A. *The author, ready for the RDF challenge: handie-talkie in one hand, two-element phased beam antenna in the other.*

Assembly

First, cut five 50-cm sections from the PVC tube. Take two sections and insert them into the PVC "T" connector to form the support for the wire element. Either cement the connections, or just secure them with nut-and-bolt sets when you attach the coax to the elements. If you use the latter method the beam will be able to be "broken down" to smaller pieces for storage. Construct the second support in the same manner as the first. Now, take the last 50-cm piece of PVC and use it as the boom to connect the two vertical sections. Use lock screws at each connection to keep the vertical sections properly aligned.

At this point the beam is physically ready, so let's assemble the electrical part. Cut four pieces of insulated copper wire, each 49 cm long, and solder ring terminals to one end of each piece of wire. Depending on the wire used, it may help to gently file the end of the wire, to allow the solder to make better contact, and so the wire will fit properly in the terminal.

Cut a 102-cm piece of 50Ω RG-58 coaxial cable for use as a delay line (3/4 wavelength, multiplied by 0.66, which is the velocity factor of the cable used). Solder another set of ring terminals to the coax. Now put the

Parts List

Quantity	Description
5	50-cm sections of 16 mm PVC tubing
2	PVC tees to fit tubing
6	nut-and-bolt sets
2	lock screws
4	49-cm sections of 1.5 mm insulated copper wire
8	ring terminals
102 cm	50Ω RG58 coaxial cable
	solder
	cement (optional)

Table 1. *Parts list for the two-element phased beam.*

electrical wire pieces (the ones you cut before) on the elements, securing them with black electrical tape. Leave some space between them so it's easier to make the coax connections. Connect the delay line between the two elements. This is a phased beam, with electrical delay of 270 degrees between elements, so make sure the connections to the delay line are not crossed. These connections can be made with short nut-and-bolt sets, or can be attached to the longer screws holding the PVC together (if you didn't use cement on the vertical sections). Finally, connect the section of cable that connects the handie-talkie and the delay line.

The antenna is ready, and you'll have assembled an inexpensive, light, flexible, portable, competitive beam. You'll be happy with your new antenna, and I'll be happy because I have been able to share the "Ham Spirit" with you.

Any questions? Please feel free to contact me at the address at the beginning of this article.

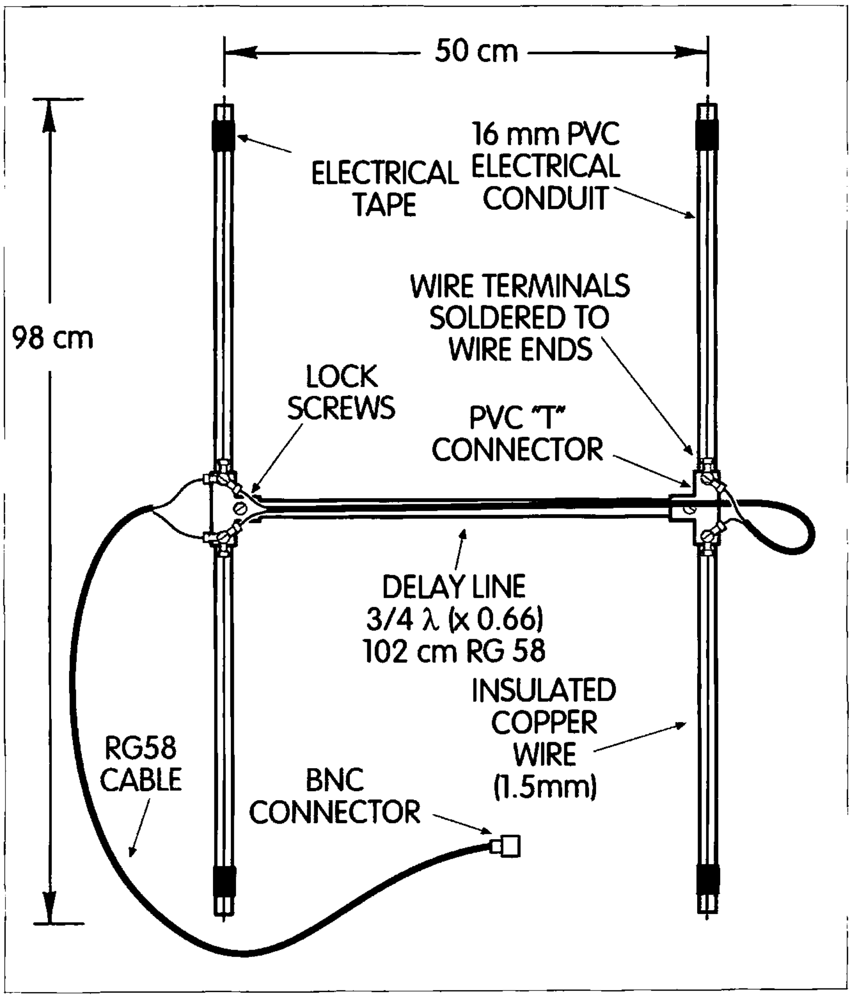


Fig. 1. Two-element phased beam for ARDF. Caution: Keep the feedline parallel to the delay line by mounting it along the boom.

Ya Gotta Shop Around

Take your time, do your homework, and get the best deal!

Jim Pickett K5LAD
9828 North 151st East Avenue
Owasso OK 74055-4852

Have you ever looked at a new rig, or even a picture of a new rig, so long and hard that you almost drooled on it? That's the way I saw the ICOM IC-706. What a great idea for a rig—a complete design; the everything transceiver. I had been using my trusty Kenwood TS-130S, which I loved, for many years. It was everything I had needed ... however ...

I used the 130 as my secondary rig at home and while camping, and sometimes ran it mobile—and it had served me well. However, that little 706 *did* have a general coverage receiver, and it *did* cover six meters, and it *did* include two meters, and it *was* all mode, and it was *so* small, and ...

I counted the money in my "squirrel fund," and collected all the loose change in the sofa cushions, plus I looked in all the nooks and several crannies to gather enough money to buy me a 706. After all, it had been more than 15 years since I had bought a new low-band rig. By the time I was actually ready to make my purchase, the IC-706 Mark II had come out and it even looked better than the original 706. I just had to have one.

I sold my TS-130S, but did not immediately jump in and call around to dealers to find the best deal on a 706 Mark II. I was anxious. I wanted to make this purchase perfect. I would take some time and check all the angles, and give every dealer I could find a chance to be my provider.

What I came to call "The Great Experiment" is the process I used to find the best deal for purchasing ham equipment, though it is, of course, equally applicable to any multi-item purchase—especially by an organization or club. The final prices can and will change. You should already be aware that any dealer's quote can change according to many factors, including the number of units in stock, proximity to the due date of a large invoice, how hard the supplier is pushing that dealer to "move more of those units," as well as other reasons.

I was interested in the ICOM IC-706 Mark II, and some of the accessories for the transceiver, including filters, voice synthesizers, and mounting brackets. I also wanted to include a couple of accessories for my ICOM IC-2340 dualbander. The request for quote was for a total of nine items, including the free separation cable being offered for the transceiver.

In early November, I contacted several dealers to get an idea of the going general discounts and prices. From my initial requests, some dealers quoted a good price on the transceiver, but some prices weren't so attractive for the accessories; some bids for the accessories were good, but not so good on the transceiver. However, I now knew the prices at which dealers were willing to sell the various items. I took the lowest price of the transceiver quotes and the lowest prices on the accessories quotes and put together a combination of the two. I added $20 for shipping and came up with my target figure.

My next step was to make up a list of ham dealers around the country, using advertisements in *QST*, *CQ*, *Amateur Radio Trader*, and *73*. I got some from the Internet sites of various ham home pages and some came from the ICOM home page which listed their dealers (a few companies did not advertise any connection with ICOM equipment so I didn't include them). If any dealers of ICOM products are not included in this list, I apologize—however, it may reflect their failure to advertise in the best-known ham magazines.

Here I must stop and provide one extra piece of information about myself.

From 1970 to 1981, I owned Derrick Electronics, a ham radio store in Broken Arrow, Oklahoma. I realize, perhaps better than most hams, what's involved in a ham radio dealership—it is neither the easiest nor the most lucrative business to operate. Most ham store owners are in business because they love the hobby and they want to help their fellow hams. Somewhere in that process, they hope they are able to make enough to feed their families and operate some really nice equipment at their QTH (sometimes in that order). The markup on ham equipment is much less than on many other items which are sold through retail stores. Ham equipment certainly does not allow the profit margins common for items such as appliances, clothing, and furniture. When you see advertisements in the newspaper for sale prices offering as much as "50% off," you know the markup has been enough to allow these deep discounts and still allow the merchant to glean at least a small profit from the sale. Ham equipment dealers are not allowed these high markups. Their profit margin is slim.

From experience, I had an idea what the dealers were paying for the merchandise I was requesting—but I had no intention of trying to get the items at cost. The dealer needs to make a profit to stay in business. I did know, however, the minimum prices being offered by various dealers. I just wanted to gather all of those prices together under one dealer's offer.

I created a letter detailing the items I wanted to purchase and the fact that I was searching for a dealer who could provide me a good price on both the transceiver and the accessories. The letter was sent out to all of the dealers on the list. I let them know that all the letters left my post office on the same day, so they knew they were playing on a level playing field.

The letter gave all the dealers two weeks, which I thought would be a sufficient amount of time to respond, before I would make my decision. I offered to pay by check, credit card, or certified check, because I realize that the dealer who accepts plastic must pay extra for using that privilege. I also suggested that if a dealer thought he had a particular reason why I should buy from him, because of something extra he offered, to let me know. Return quotes could be made via E-mail or snail mail and I listed addresses for both.

One dealer offered me additional information, including the telephone number of the service department, on how I could call ICOM directly to get the service manual, and I appreciated that. Actually, when I called ICOM, their price was considerably higher than many of the dealers had quoted for the manual. I suspect that many service manuals do not have a posted retail price, and a dealer is free to price them according to what the traffic will bear.

When the responses began to arrive, I placed a number and date on each and entered the information into a spreadsheet (**Fig. 1**). The spreadsheet also listed the name of the quoter and their E-mail address, if provided. I noted on the spreadsheet whether an item was quoted as back-ordered, used, or discontinued and/or unavailable from that dealer.

Most quotes showed a breakdown on an item-by-item basis. However, a few

Dealer	IC-706 MKII Xcvr	FL-223 Filter	MB-62 Bracket	MB-63 Bracket	UT-86 Tone Squelch	UT-102 Synthesizer	UT-55 DTMF Decoder	UT-66 Synthesizer	Shipping	TOTAL
1	1249.00	79.00	20.00	14.00	63.00	55.00	49.00	59.00	14.55	1602.55
2	1270.00	70.00	17.00	12.00	46.00	50.00	50.00	55.00	20.00	1590.00
3	1269.95	99.95	25.95	18.95	69.95	74.95	69.95	83.95		1713.60
4	1279.95	79.95	22.95	16.95	64.95	64.95	59.95	n/a		1589.65
5	1269.95	99.95	25.95	18.95	69.95	74.95	69.95	83.95		1713.60
6	1279.95	69.95[1]	16.95	11.95	45.95	48.95	45.95	54.95	20.00	1594.60
7	1299.00	80.00	25.00	18.00	69.00	60.00	56.00[2]	60.00		1640.00
8	1149.95	82.95	19.95	13.95	54.95	58.95	54.95[3]	63.95		1499.60
9	1279.95[1]	84.95	25.00	18.00	69.00	74.00	69.00[1]	74.70[1]	20.00	1714.60
10	1249.00	70.25	17.05	12.30	49.35	49.35	Discont.	Discont.		1482.30[4]
11	1245.00	67.50	20.00	14.00	60.00	49.00	45.00	53.50	32.50	1586.50
12	1189.95	75.00	22.00	15.00	55.50	55.50	65.00[5]	65.00[5]		1592.95[6]
13	yes	yes	yes	yes	yes	yes	yes	yes	yes	1589.00[7]
14	1239.95	89.95	20.00	14.95	64.95	64.95	n/a	n/a	29.00	1523.75[8]
List Price	**1599.00**	**105.00**	**25.95**	**18.95**	**69.00**	**74.00**	**69.95**	**83.95**		**2045.80**

All prices in dollars. Key: [1]Back-ordered. [2]Used. [3]1-2 weeks. [4]Not all items, service manual \$35. [5]Special order. [6]Service manual \$50. [7]Including service manual. [8]Service manual in stock but no price quoted.

Fig. 1. Sample spreadsheet.

dealers offered a package price for all items. *Caution: Be sure that when a total price is listed, that all items requested are included.* Several of my quotes looked really good at first, but on closer examination I discovered an item or two had been omitted. I do not believe this was intentional and in a few cases the particular item was left off because that item was no long available to the dealer. A couple of dealers included the cost of the service manual as a part of the whole, rather than pricing it separately, as I suggested. This skewed the total so I entered a notation to that effect on the spreadsheet. Just be sure, when you are comparing final prices, that *all* items requested are listed. Numbers 4, 10, and 14 on the spreadsheet were examples of how the quote was incomplete. Number 7 was quoting one accessory item as "used" but did make a note of it. Their price on that used item was higher than the "new" price from another company.

It was interesting to note that some quotes, whether by E-mail or by regular mail, made a good first impression ... and some did not. Some were carefully and neatly submitted on a "Quote Sheet" form, some on a computer-generated printout, some carefully typed, some in easy-to-read E-mail, but a couple were just hand-scribbled. I got the definite feeling from some that the quoter was saying to me, "Here ... take it or leave it!" Others made me wish their proposal was better because I would like to do business with them—and probably will, in the future.

Even though I specifically placed a closing date in the letter sent to each dealer, and it gave them all nearly two weeks, I received one quote on the day after the closing date. That letter had been postmarked only two days prior. Quite a few dealers who received the letter made no attempt to provide a quote. Maybe they did not sell ICOM, maybe they did not have any of the requested items in stock, maybe they thought they could not match my target price, or maybe they were offended by my method of obtaining a quote, but I believe I did get a good representative sample of the 46 dealers queried.

Several companies have sites operating under the same name, located in different areas of the United States. I sent letters to all of the sites, even though they appeared to be parts of the same company. I discovered that some of these groups quote exactly the same prices for each piece, as though they accessed a central price data base. Other stores, sharing the same name, were organized more casually; it seemed as though they were simply linked together to allow quantity buying, and the stores were operated independently. I got quite a variation in prices from this group, although they were typically very competitive and interested in helping me find a good deal.

The quote I chose from dealer number 8 simply blew all the others away and had I not done "The Great Experiment," I might never have found that company—I hadn't previously bought from them. After tentatively deciding on that particular dealer's offer, I called them on the phone to make sure their quote was just as I had requested: "New equipment, in the box, no demo, with full warranty." The man on the phone was helpful and pleasant and gave me additional assurance that I had made the correct choice in dealers. Their quote had come via E-mail and listed the quoter's name, which I appreciated. The person who had provided my quote from this dealership was not there at the time I called, but the man I spoke with had no problem making the sale from the information I had received.

The dealer I chose had offered me two prices, either using a credit card or paying by money order, but told me a credit card would be quicker. My call to the dealer was on a Friday, and my new IC-706 Mark II, complete with accessories, arrived on the following Tuesday. A couple of accessories were back-ordered but the seller noted that they would pay for shipping when those items arrived.

I have deliberately chosen not to name the dealers who participated in this experiment. As previously noted, a dealer may offer an entirely different bid at dates separated by months or even weeks. I attempted to make my target price a fair figure, based upon sample proposals received prior to the beginning of the experiment, and also upon my experience as a ham dealer. I believe dealers should always have a chance to make a profit, or they cannot stay in business. As a matter of fact, of the 46 letters sent out, I got two back unclaimed, and I assume that it was because two of these dealers are no longer in business.

One note of interest came when the package arrived. My invoice showed that a coupon for $100 off had been used. I knew ICOM was offering a coupon for $100 off on the older IC-706s but I was unaware of any such deal on the Mark II. The dealer had used a $100 coupon to make my quote attractive enough that I would make my purchase from them—and I had the radio in hand. Several days later, while scanning ICOM's Web page, I discovered that, beginning on December 5, during the time that dealers were reading my letter and preparing their quotes, ICOM had started offering an instant $100-off coupon on the Mark II. All dealers I contacted had the same opportunity to use this coupon to make my quote better, but only one, to my knowledge, had used it. Maybe the other dealers were unaware of the promotion since it had just begun, but because my dealer had checked either the mail or the ICOM Web pages, it allowed them to offer me the best deal. Their attention to business made the difference.

A close look at the spreadsheet shows the wide variation between prices on the accessories quoted. For instance, the MB-62 mobile bracket, which lists for $25.95, drew variations in price from $16.95 to the full list price. Also, the UT-102 voice synthesizer for the 706, which listed at $74.00, brought quotes from $74.95 to $48.95. Perhaps the source from which I got the list prices had incorrectly shown this item at $74.00 when it was actually $74.95. I would hate to think a dealer quoted me a higher-than-list price. One reason for the extra-attractive prices on the UT-55 and UT-66 for the IC-2340 may be that they

were being closed out as an older product, although not all quotes would suggest that.

This experiment proved to me that it was worth the extra effort to shop around. Do the dealers like this? I believe they do—it probably gives them a better opportunity to compete against other dealers. Remember, the target figure must be realistic: The dealer *must* make a profit.

I'm grateful to all the dealers who participated in my "Great Experiment." My only suggestion to a dealer would be to look over the quote you're sending to a customer and ask yourself: Does it look like you really want to gain that person as a customer? Is it signed, or does it at least have an actual person's name listed, so your customer can call back and talk to the quote provider? If you have an E-mail address or a site URL, did you provide it? Look at the correspondence you send out to others—what is *your* impression of your company, judging by what your *customers* see? How do others see you?

Not all of the larger dealers have the best prices or service. Many smaller dealers are willing to make you a good deal and provide you with good service—and they deserve your business, but you have to give them a chance. Perhaps their not having toll-free numbers means they don't need to make quite as much profit from sales in order to pay their phone bills.

If your curiosity is just too great and you want to know who my actual provider was, drop me an E-mail at [jpk5lad@bigfoot.com]. You'll need to do your own "Great Experiment" to find out the identities of all the other dealers, both those who responded and those who did not.

By the way, I really do like my new IC-706 Mark II. Yes, it was all worth it. As an aside, as I was finishing up on this article, the UPS driver rang the doorbell and left me a postage-paid package with the three back-ordered items: the 706 Mark II Service Manual, the UT-55 DTMF encoder/decoder and the MB-63, which is the mounting bracket for the 706 control head.

HAM TO HAM

continued from page 63

respectable job for a 'compromise' top band skyhook! What follows is what I've found to work nicely at my QTH and it should be adaptable to others.

"By the way, an earlier version of this idea was described in *CQ Magazine* some years back, but this latest configuration seems to give better results (at least subjectively) at a very small additional cost in terms of setup time and materials. Remember, this is a temporary, stow-it-away-when-you're-not-using-it modification. The main addition is the Adapter Shorting Box shown in **Fig. 1**. It's nothing more than a way of connecting the shield and center conductors of the coaxial downlead from the G5RV dipole together—shorting them together, if you like. This turns the centerfed G5RV dipole into a top-loaded or 'T' type of vertical radiator. Next, two counterpoise wires (or radial wires), each 165 feet long, are added to the base (adapter box) connector that eventually connects to my transmatch (antenna matching unit) back in the shack. The two 165-foot counterpoise/radial wires are wound up onto a section of cardboard tubing, and unwound and laid out on the ground when I want to configure my G5RV for top band. Most of us can't unwind 165 feet of wire in a straight run, and neither can I, so the counterpoise/radial wires end up making something like a large 'S' shape on the ground—but the wire is still out there. To help keep the counterpoise/radial wires in place, I've made up several six-inch lengths of wooden two-by-four section 'anchors,' each with spring-action wooden clothespins glued and nailed to the two-by-fours. I place one of these 'anchors' at each bend in the counterpoise/radial run to keep the wire from being blown or kicked around while it's out and in place.

"That's basically it ... I've found that the G5RV, configured as I've described, and operated via a transmatch in my shack, will give me a usable bandwidth comparable to what I'm able to achieve with the 'stock' G5RV antenna on 80 meters—not bad! The estimated vertical radiation pattern is reasonable as well, and **Fig. 2** gives you an idea of what you might expect if you decide to duplicate the idea. Again, my original goal was to be able to operate on 160 meters, with a usable signal, primarily for contests and other short-duration work, without the need to erect a dedicated top band radiator. By using this technique, and the information shown in the *ARRL Antenna Handbook* and published by ON4UN, I ended up with a satisfying compromise antenna with very little effort or cash outlay. Give it a try at your own station."

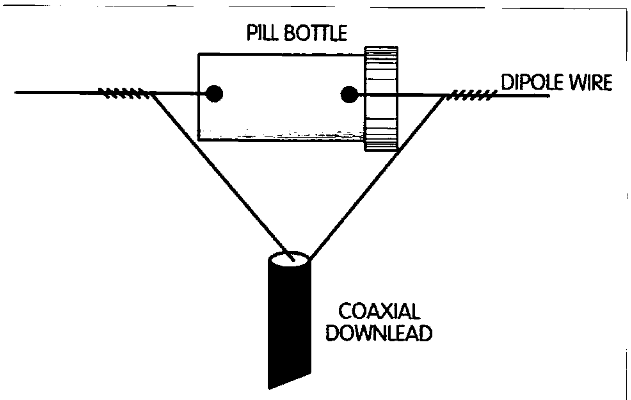


***Fig. 3.** Indoor wire dipole using a discarded pill bottle as the center insulator.*

Fuse tale

From Bob Boehm N8EXF: "After struggling to remove the tiny GMA-style fuse mounted on the printed circuit board of my Kenwood TS-50 after it opened, I decided to make my life a little bit easier the next time that fuse might give out. I cinched a small nylon cable tie around the new fuse's body, leaving enough 'tail' on the cable tie for me to easily grab it, before replacing the fuse in its clips. The cable tie's 'tail' will make the chore much easier, if and when the tiny fuse needs replacement in the future. Of course you can adapt the idea to any small cartridge-style fuse in any hard-to-reach location."

Not quite what the doctor ordered

From Harold Proppe Jr. K6QVD: "Now that I'm a senior citizen, I've discovered the 'advantage' (?) of having lots of empty plastic prescription pill bottles to dispose of! In addition to storing small parts, they have other uses in and around the ham shack. If you need a quick coil form or a lightweight dipole antenna insulator (**Fig. 3**), a pill bottle will often be just the ticket. They're also useful as small containers for holding tiny circuits (for interfacing one gadget to another) or perhaps enclosing a switch or jack for this and that purpose ... and because they come in many varied sizes, keeping a stock of them on hand will usually produce the one that's just right for the project in mind."

Moderator's note: It's easy to test a pill bottle's RF insulating qualities if there's any question of its propriety for use as a coil form or insulator as Harold suggested. Just place it in a microwave oven for 60 seconds or so, along with a small glass of water to act as a known load, and see if the pill bottle gets hot to the touch. If it doesn't, you know that it's RF transparent. Ultraviolet light can also disintegrate many plastics, so before using an unknown plastic as a permanent outdoor antenna insulator, set one outside, exposed to the sun for a while, and see how much it's affected. For indoor or attic antennas, UV susceptibility isn't a concern.

Murphy's Corollary: The farthest distance between two points is usually the shortcut.

Many thanks, as always, to this month's very much appreciated supporters, including:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Thomas Hart AD1B
54 Hermaine Avenue
Dedham MA 02026

Bob Boehm N8EXF
6821 Le Conte Avenue
Cincinnati OH 45230-2935

Harold L. Proppe Jr. K6QVD
1385 Skyline Drive
Laguna Beach CA 92651

If you're missing any past columns, chances are you'll be able to find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas you would like to see included in *73 Magazine*'s "Ham To Ham"

Continued on page 71

Number 71 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

NET DESIGNATION	DAY	TIME	FREQUENCY (MHz)
AMSAT International	Sunday	1900 UTC	14.282
AMSAT International	Sunday	1900 UTC	21.280 (inactive)
AMSAT International	Sunday	2300 UTC	18.155 (inactive)
AMSAT-NA East Coast	Tuesday	2100 local	3.840
AMSAT-NA Mid-America	Tuesday	2100 local	3.840
AMSAT-NA West Coast	Tuesday	2000 local	3.840

***Table 1.** International and regional HF AMSAT nets.*

On Tuesday, January 6, 1998, the Houston AMSAT Net celebrated its 200th airing via geostationary commercial satellite. To mark the event, several guests were invited to take part via phone patch, including AMSAT President Bill Tynan W3XO, Executive Vice President Keith Baker KB1SF, Vice President for Manned Space Operations Frank Bauer KA3HDO, Vice President of Engineering Stan Wood WA4NFY, and Spacecraft Integration Manager Lou McFadin W5DID.

In addition to the satellite feed, the net was available via VHF and UHF FM repeaters in many parts of North America, local amateur television in Houston, live audio on the Internet, and later retransmission from WAØRCR on 160 meters.

Are radio nets dead?

The amateur satellite program and associated radio nets easily predate personal computers and the relative ease of global communication we now take for granted. Today we can quickly locate information about hamsats and related topics via the Internet. A great place to start is the AMSAT North America Web page at the URL (Universal Resource Locator) [http://www.amsat.org]. But when you get there, the message conveyed by the site is about radio and satellites, not computers, cool graphics, and digital desktop technology. The Internet and the World Wide Web are only a tool or a means to an end. Your line of communication to the Web is as tenuous as the twisted pair of phone lines or slender fiber optics that make the connection possible. As long as all the puzzle pieces work, it's wonderful. When your Internet service provider (ISP) goes down, or something else happens, it's a mess.

AMSAT and nets

For many years, the shortwave AMSAT nets were the primary source of up-to-the-minute hamsat information. **Table 1** (from [http://www.amsat.org]) shows the current international and regional AMSAT nets. The international nets were scheduled for Sunday afternoon for optimum propagation and universal acceptance. The weekday nets were scheduled for Tuesday evening, since Wednesday (UTC) used to be the official recharge or experimenter day for the hamsats of the 1970s. While the satellites took a day off, operators got together for the latest operating schedules and news. Those nets shown as inactive will be reinstated as the sunspot cycle improves.

During the early years, without global computer networking, the net control station (NCS) for the 20-meter international net would be tasked with collecting and distilling bulletins for transmission and discussion on Sunday afternoon. For the Tuesday night East Coast net, the responsible NCS would collect current satellite news and bulletins from the Sunday 20-meter net and other sources. During his net he would read the material, take check-ins and answer questions. The Mid-America NCS took notes from the East Coast net to add to his own information and observations. The process continued for the West Coast. While the system worked, some details were lost from Sunday through late Tuesday.

Current nets rely heavily on the Internet-based AMSAT News Service (ANS). Various AMSAT volunteers over the years, including WA2LQQ, WDØHHU, WTØN, and now NNØDJ, have accepted the duty of putting together pertinent news items every week. AMSAT officers like W3XO and KB1SF have stepped in on occasion during times of illness or schedule conflicts to provide the service. You can subscribe to ANS bulletins by sending E-mail to [listserv@amsat.org]. Simply ask to subscribe to ANS in the body of the message. The system is not automated, so message format is not critical. Other subscription services include AMSAT-BB—a forum of hamsat-related discussions; KEPS—the latest Keplerian element sets for satellite tracking; and SAREX—a forum for the Shuttle Amateur Radio Experiment.

With an information-laden Web site and extensive news and data distribution services, why bother with AMSAT radio nets? The answer is simple. Radio is our hobby and radio nets can be a live, fully interactive method to not only relay information but also to discuss amateur-satellite topics directly with others, using radios.

Local AMSAT nets

While the shortwave AMSAT nets can be very informative, conditions on the low bands can be erratic. Various groups around the country have taken the initiative to sponsor local VHF and UHF AMSAT nets to get the word out. Some satellite operators have very limited low-band equipment or, due to no-code licenses, none at all. A listing of some current local nets is shown in **Table 2**. Check the list for a local net near you. A few groups even have Web sites advertising their nets and local projects. The Colorado AMSAT Net page can be found at URL [http://www.idcomm.com/personal/nØvse/]. The Southeast

Continued on page 74

HAM TO HAM

continued from page 70

column to Dave Miller NZ9E at the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

New Products

Turn Your PC into a Scanner

Sony's got a new radio scanner, the ICF-SC1PC, that gives controlled access to the airwaves with the click of a mouse. Operation is easy—the searching options are right there in front of you, as icons on your computer screen. You can tailor searches and create custom files; a supplied CD-ROM lists more than 3,000,000 records of FCC-licensed radio frequencies in the US, including public safety, marine frequencies, aviation, and more.

Check at your electronics, hobby and specialty stores for the ICF-SC1PC; the package includes the scanner, CD-ROM, interface cable, and interface software, with a suggested retail price of $429.95. Questions? Call (800) 222-SONY (7669).

Tokyo Hi-Mound Available Again

Milestone Technologies announces that the Hi-Mound range of Morse keys, paddles, and bugs is back—though it was formerly priced out of the US market by the value of the Japanese yen, recent currency stabilization has made import possible again. The line includes a complete range of keying equipment, from the simple and inexpensive to the "work of art," all at prices comparable to or better than other products available in the US, and they're all available from Milestone Technologies, 3140 S. Peoria St., Unit K-156, Aurora CO 80014-3155. For more information, call (303) 752-3382 or visit the Web site at [http://www.mtechnologies.com].

Found In Space:

The Radio Amateur's Satellite Handbook, by Martin Davidoff K2UBC, from the ARRL, which avers that it is the most comprehensive book ever written on amateur radio satellites, and that it will become the new standard for hams who want to experience the thrill of contacting other stations via an orbiting spacecraft. We suspect they're right, because the author also wrote the League's previous satellite book, 1984's *The Satellite Experimenter's Handbook*, the preferred reference work for more than 10 years.

The 372-page *Satellite Handbook* covers all aspects of the amateur satellite program, including tracking, station equipment and antennas, operating tips and techniques, and much more. There's a history of all the amateur spacecraft beginning with *OSCAR I* in 1961, and details of software and Internet sites of interest to keep you up-to-date. To order, send $22 plus $5 for shipping and handling (to US addresses) to: ARRL, 225 Main Street, Newington CT 06111-1494; or call toll-free (888) 277-5289; or shop via the Internet at [http://www/arrl.org/].

Air of Distinction

MFJ's new Deluxe Headset Microphone lets you cruise around looking very cool, in a tech kind of way. It's super-lightweight, comfortable, durable, and has superb transmit and receive audio. Whether you're slipping through an airport, sliding through traffic, or slobbing on your sofa, this headset lets you carry on a private QSO while doing other things. The mike can pick up your voice whether you're hollering or whispering; the earphone gives such great tonal quality that even distant stations will come in loud and clear.

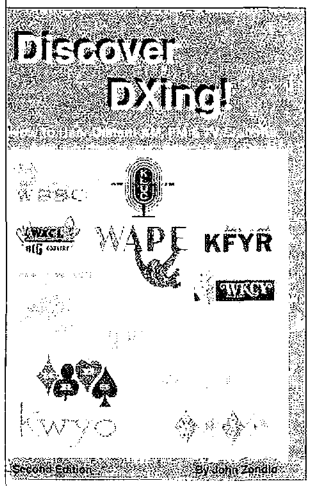
A small PTT switch can be attached to your shirt or pants pocket, your lapel, or inside (don't ask) your shirt—it measures only one-half-inch by one inch, and it's so durable even the most dedicated rag-chewer can't wear it out.

Receive impedance is 150Ω with a sound pressure level of 108 dB. Maximum input power is 30 mW and frequency range is 100 Hz to 5 kHz. The transmitting microphone is condenser-type, with low impedance and -42 dB V/Pa sensitivity. Frequency range is 20 Hz to 16 kHz.

The MFJ-288I works with ICOM, Yaesu, Standard, ADI, Radio Shack, and other compatible hand-held transceivers. The MFJ-288K works with Kenwood and compatible hand-held radios. Either model is only $24.95, and of course it's covered by MFJ's famous *No Matter What*™ one-year limited warranty.

To order, or for information about your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or check out dealer and ordering information on the Web: [http://www.mfjenterprises.com].

Discover DXing!



That's not just good advice. It's the title of a book by John Zondlo, published by Universal Radio, Inc. Here's your nontechnical introduction to hearing more AM, FM and TV stations. Topics include propagation, seasonal conditions, antennas and lots more on how to hear all 50 states on AM, all in an easy, conversational style. Get a copy of this 90-page second edition for $5.95 from Universal Radio, Inc., 6830 Americana Pkwy, Reynoldsburg OH 43068-4113. Call toll-free to order (800) 431-3939 (order #0019, ISBN 1-882123-45-X), or (614) 866-4267 for more information.

Better Late Than Never

Contact East's new 1998 General Catalog was available in January but with our lead time for announcements ... well, anyway, it's a terrific color catalog chock-full of anything you might need for testing, repairing, or assembling electronic equipment—and they offer same-day shipping; next-day delivery anywhere in the US! That's right—and there must be something in these nearly-300 pages that you can't live without. If you haven't already got your free copy, call (978) 682-2000; FAX (978) 688-7829; or request on-line at [www.contacteast.com].

AREA	DAY	LOCAL TIME	FREQUENCY (MHz)
AR-LA-TX QCWA Net	Monday	1930 (2000 during summer)	146.670
Boston Area SPOT Net	Friday	2130	145.230
Central CA (Fresno)	Sunday	2000	146.940
Central NY	Monday	2000	146.880
Central OH	Sunday	2000	145.490
Colorado	Wednesday	2000	145.160, 145.460, 147.225, 224.980
Dallas/ Ft.Worth	Wednesday	1945	147.140
Derry NH	Friday	2000	146.850
Detroit MI	Tuesday	2000	145.330, 224.580, 442.800, 1282.050
Harrisburg PA	Sunday	2000	145.210
Houston TX Area	Tuesday	2000	147.100
Kansas	Sunday	2000	145.190
Long Island NY	Tuesday	2000	147.075
Portsmouth NH	Thursday	2000	146.805
Saco ME	Sunday	2000	146.775
SW Ohio	Tuesday	2000	145.110
Tucson AZ Area	Wednesday	1900	146.880
Waltham MA	Thursday	2030	146.640
Washington DC Area	Sunday	2100	146.835

Table 2. *Local VHF/UHF AMSAT nets.*

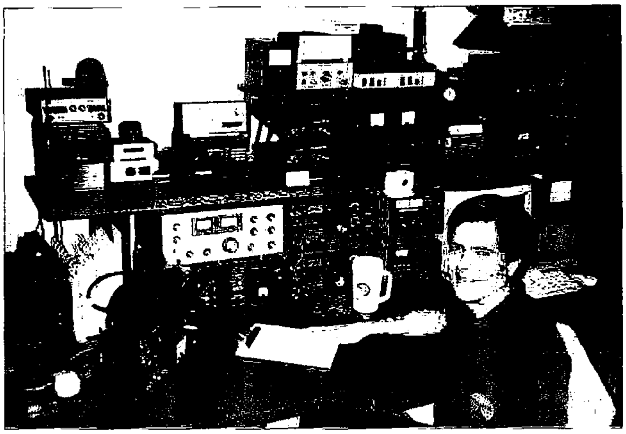


Photo A. *The author, W5ACM, handles net control and bulletins for the Houston AMSAT Net.*

HAMSATS

continued from page 71

Michigan AMSAT Net page can be found at [http://www.wwnet.com/~jsmyth/intro.html]. The Houston Area AMSAT Net Web page is at [http://www.amsatnet.com]. Participation has been on the upswing in recent years.

The Houston connection

Prior to the attempted launch of Phase 3A in 1980, a group of hams in Houston used to get together on two meters to discuss their efforts to build antennas and equipment for the first high-orbit, long-life hamsat. No one had any experience with elliptical orbit calculations or the more stringent requirements of working stations through a satellite of this type, so the discussions became a net, a forum to exchange information. Phase 3A never made it into orbit due to a failure with the *Ariane I* launch vehicle, but various Houston net participants kept meeting on Tuesday nights after the Mid-America 80-Meter Net to talk about satellite DX, radio equipment, and computers. During the last 18 years the net has thrived, continued with discussions and news dissemination, moved to repeaters, and tried some interesting experiments.

In an effort to expand coverage of the Houston AMSAT Net, Craig Davidson WD5BDX, trustee of the Houston Net host repeater on 147.10 MHz, got permission to phone the net audio to a commercial, C-band, geostationary satellite uplink site that had some free audio-subcarrier time available. It was fun, merged in another high-tech communications medium to the net, and brought in listeners all over North America. In order to keep the operation on a low budget, it was necessary to change the day and time of the Houston Net to follow the availability of free satellite time.

Over the course of a few years, some stability was finally reached with the WØKIE Network in Oklahoma. Mike Reynolds' WØKIE offers inexpensive satellite uplink service to a number of groups involved with ham and shortwave listener (SWL) activities. For well over a year, the Houston AMSAT Net has been live on the Ku-band satellite SBS-6, transponder 13b, audio subcarrier 6.2 MHz. SBS-6 is located at 74 degrees west, just next to Galaxy 6. The time of the net has moved to 8 p.m. Central time, and is now on Tuesday nights, an hour before the regional, 80-meter, Mid-America AMSAT Net. The Houston group has had several net control stations over the years. With plenty of help from others, I have been the primary NCS for the past few (see **Photo A**).

A lot of hams have satellite-TV systems and, if they have Ku-band capability, can tune in the Houston Net with ease. For others, there are alternatives. Bruce Paige KK5DO had been experimenting with real-audio via the Internet in addition to his duties as the station in command of the uplink feed audio (see **Photo B**). The real-audio feed worked but was difficult to maintain and somewhat erratic. Another Houston ham, Greg Rice KB5OAT, came forward to provide the Internet connection through his Internet site at [greggo.com]. Linking to the live feed (or to check out the previous week's net) is done

Photo B. *Bruce Paige KK5DO is counted on for Internet check-ins, real-audio, and geosat audio control.*

through the Houston AMSAT Net Web page [www.amsatnet.com]. The real-audio feed has never been better and check-ins from around the world have been common.

A number of groups around North America have taken the initiative to capture the satellite or Internet feed and put it out over their local VHF and UHF repeaters. A list of these can be found at the Houston AMSAT Net Web page. George W1ME and Dana K4LK were a few of the first hams to connect regional VHF/UHF repeater networks, in New England and Florida respectively, to the Houston Net.

Vern Jackson WAØRCR in Missouri records the Tuesday net for later distribution on 160 meters. Every Saturday night at 9 p.m. Central, Vern carries the Tuesday audio on 1860 kHz AM. Although it's not "real-time," it has become popular with a growing number of hams in the central US.

Nets are supposed to be interactive, and the Houston AMSAT Net is no exception—it's just different. Houston hams can check in, ask questions, and make announcements through the local two-meter machine. They can also see the NCS on amateur television (ATV) through the Houston Amateur Television Society (HATS) repeater on 421.25 MHz. Those listening via the Internet or commercial satellite feed can use other methods to do the same. Bruce KK5DO monitors the Internet Relay Chat (IRC) site: irc, /server irc.chelmsford.com,6667, /channel #amsat. He can also receive E-mail during the net at [KK5DO@amsat.org]. Snapshots of the HATS ATV can be viewed on the Internet at [http://www.stevens.com/HATS]. The picture is updated every two minutes using "web-cam." Those who are not local and not on the Internet can call in via phone at (713) 467-9870. Marty Smith WD5DZC collects information for the net and takes the phone check-ins (see **Photo C**).

Photo C. *Marty Smith WD5DZC takes care of phone check-ins and material content.*

The availability of the Houston AMSAT Net via these many forms is dependent on the volunteers who take their time to make it happen, as well as the use of the commercial connections. From these experiments, the group hopes to find the best and most effective means to distribute information about our favorite hobby, radio via hamsats. Check out the net listings and join us! 73

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/
homingin/]

Build an offset attenuator

Has your club held its first hidden transmitter hunt of this spring yet? In recent months, "Homing In" has thoroughly covered special transmitters, controllers, and portable antennas for radio direction finding (RDF). With these items and the two-meter handie-talkies that almost all hams own nowadays, your club is almost completely equipped to start on-foot fox hunting, sometimes called fox tailing, radio-orienteering or ARDF. But before you're ready to go out and bring home the trophies, you will need one more accessory.

The fox's signal at the start of a hunt may tickle your receiver with only a fraction of a microvolt. But when you get in close, your handheld could get pounded with nearly a volt of RF, even if the transmitter is running low power. The S-meter circuit of a typical VHF-FM rig won't help you get bearings at that level. It probably reaches full scale at 10 microvolts, giving only about 30 dB range from minimum to maximum. Limited range is good because it's easy to see the meter peaks when you swing a directional antenna, but it's bad because your meter will stay pinned when the signal is strong.

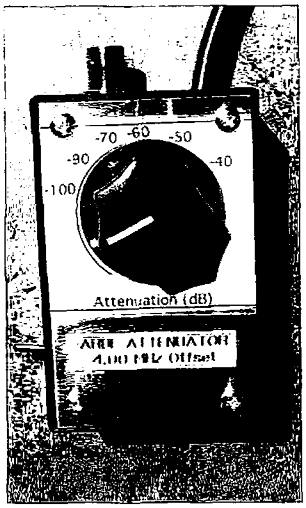


Photo A. This offset attenuator for two-meter fox hunts is easy to build from parts you can probably buy in your home town. Photos by author.

An RF attenuator is a device that goes between antenna and receiver to reduce the signal strength down to within the range that the receiver S-meter can handle. Without one, you may think you're close to the fox when indeed you're still far away, and you won't be able to get close enough to a camouflaged/hidden T to identify it. The amount of attenuation should be adjustable so that you can add from just a little when your S-meter first pins, up to a lot as you get within a few feet. Special ARDF receivers used by champion fox hunters have electronic attenuation built in, but ordinary handie-talkies don't. Adding it would require major micro-surgery in the HT.

To solve leakage, QSY

External resistive (sometimes called "passive") attenuators are popular for mobile T-hunts. They have several shielded sections, each with resistors to soak up the RF signal and a switch to put the section into and out of the line. But they are not the answer for on-foot hunts, because handie-talkies and scanners are notorious for poor case shielding. A passive attenuator cuts down the RF voltage into the antenna jack, but strong signals will still penetrate the case and pin the S-meter.

A better way to get bearings on nearby foxes with HTs is to convert the strong on-frequency signal into a weaker off-frequency signal. Then you can tune your receiver to the offset signal and measure its strength versus direction, either with a dedicated RDF antenna or the "body shield" maneuver.

When this type of device was originally described six years ago by Anjo Eenhoorn PAØZR, it was called an active attenuator. Since there are other kinds of attenuators that are also called "active," I prefer to call it an offset attenuator. That term describes how it solves case leakage by offsetting the signal frequency. An offset attenuator consists of a local oscillator (LO) connected to a diode mixer through the attenuation control. The higher the LO level, the higher the amplitude of the offset signal applied to the receiver. To increase attenuation, decrease the LO signal into the mixer with the control.

The offset attenuator of **Photo A** is so easy to build that it makes a good project for every member of your club, especially if experienced builders help out the first-timers. You can obtain all parts for about $20 from your local Radio Shack™ store. RS part numbers for the components are included in **Table 1**, the parts list. All items should be in local stock except X1, which will be shipped directly to you a few days after you order it at the local store. There's nothing about these items that is exclusive to The Shack. You should be able to find equivalents for all of them at most electronics parts outlets, and perhaps at lower prices.

Nowadays, hams expect a special circuit board for every ham construction project. Not this one. There is so little wiring that it simply isn't necessary.

Parts List

C1, C2	470 pF ceramic disc (RS# 272-125)
C3	.0047 μF ceramic disc (RS# 272-130)
R1, R2	2.2 k 1/4 W (RS# 271-1325)
R3	4.7 k 1/4 W (see text)
D1	1N4148 diode (RS# 276-1122)
J1	UG-1094 BNC socket (RS# 278-105)
VR1	5 k audio taper potentiometer (RS# 271-1720)
S1	Toggle switch (RS# 275-625A)
U1	7805 regulator, +5 V (RS# 276-1770)
X1	4.0 MHz oscillator (RSU1321221)
Enclosure and board (RS# 270-283)	
Battery connector (RS# 270-325)	
Knob (RS# 274-424)	
BNC Cable (RS# 278-964)	

Table 1. Parts list for the offset attenuator.

A universal project board works just fine. I used Radio Shack #270-283, which is a 2- x 3-1/4- x 1-3/8-inch plastic box with an aluminum cover and a pre-drilled 1-7/8- x 3-inch circuit board mounted inside. J1 is a BNC connector to mate with the cable from your RDF antenna. The output cable has a BNC plug to match the antenna connector of many handhelds. If your antenna or radio uses different connectors, make changes accordingly.

Radio Shack carries two types of rotary potentiometers, linear taper and audio taper. Audio taper is best for VR1 because it spreads out the high attenuation values on the dial when you wire it so that high attenuation is on

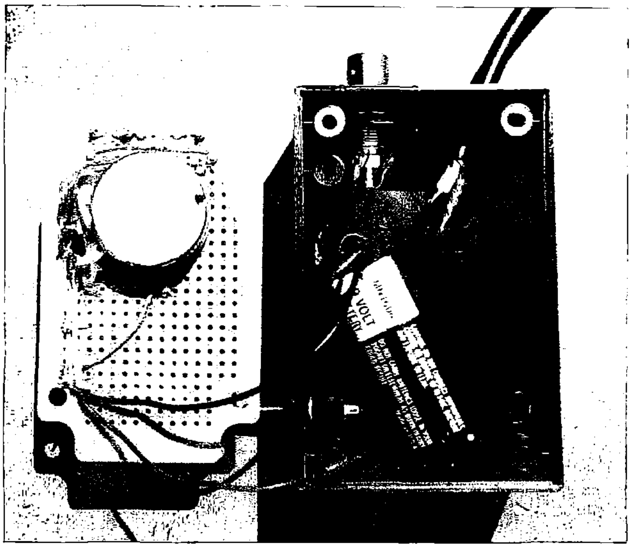


***Photo B.** Interior of the attenuator showing a rear view of the circuit board before final assembly.*

the counterclockwise end, like a volume control. If you don't have a stock of quarter-watt resistors in your junk box, buy the five-pack of 2.2 k resistors. For R3, use two of the 2.2 k resistors connected in series.

S1 is a subminiature toggle switch. It's easy to accidentally bump it to the ON position when you pitch the unit into the back seat after the hunt. If you are good at making square holes, you can replace S1 with a slide switch to minimize the chance of accidentally run-down batteries.

Step-by-step construction

Cut the shaft of potentiometer VR1 to 5/8 of an inch, as measured from the outside end of the bushing. Following **Photo B**, drill a 5/16-inch hole, one inch from the top edge of the circuit board, centered between the left and right edges. Drill holes in the box for the coax receptacle (J1) and the RG-58 output cable (a BNC jumper cable with one connector cut off). Drill a hole for power switch S1 in the lower left side such that there is plenty of room for the battery and VR1 when everything is assembled. Mount VR1, J1, and S1, oriented as shown. The copper etch on the circuit board goes on the same side as the body of the potentiometer, toward the interior of the box.

Strip the center conductor and braid of the output cable as shown. Solder a one-inch bare wire to the ground lug of J1 and connect one end of C1 to the center pin of J1. Extend the bare wire and unconnected end of C1 upward, to be connected later.

Mount U1, X1, D1, C2, and the three resistors on the top (no copper) side of the board with the leads extending through holes to the copper etch side, per **Photo C**. Install two terminal pins (RS #276-1987) on the input (signal and ground) for later connection to J1, and two pins on the output side for the wiring to P1. Wire the pins and all the parts on the board per the schematic diagram, **Fig. 1**. Tie all the ground nodes together with bare wire. Install C3 on the rear of the board from the clockwise lug of VR1 to the crystal oscillator output. Use insulated wire for jumpers and the regulator output.

The crystal oscillator is designed to fit in the same board space as a 14-pin dual-inline IC. One corner is squared instead of rounded, corresponding to the location of pin 1, which has no internal connection. There is also a marked dot on top of the cover at this location. Counting clockwise from that pin as viewed from the bottom side of the oscillator, the next pin (7) is ground, the next (8) is the output, and the next (14) is supply +5 V.

Wire the battery connector and S1 into the circuit. If you have a voltmeter, turn on S1 and check for +5 V at the regulator output pin. If you have an oscilloscope, verify a 5-V peak-to-peak square wave at the oscillator output pin. Turn off S1 when you are finished.

Now it's time to put it all together. Solder the center conductor and shield of the output cable to the output terminal pins on the etch side of the board. Put the board in the box, extending the leads from J1 through the holes on the top left. With the board mounted in place with two supplied screws, tack-solder the J1 leads to the input terminals. Drill a 5/16-inch hole in the aluminum box cover, 1-1/16 inches from the top, centered between left and right, to clear the shaft of VR1. Make cover labels using your favorite technique, then install the cover and knob.

Antidote for overload

Using an offset attenuator for on-foot fox hunting is easy and efficient, once you get the hang of it. An S-meter on your receiver is a big help in getting RDF bearings with this attenuator and a small beam or quad, but it is not mandatory. You can open the squelch and use the quieting property of FM signals to get a good idea of signal direction.

At first, get bearings on the fox's frequency with S1 turned on. Start with the dial full clockwise, which is minimum attenuation (about 4 dB). Increase attenuation as necessary by turning the knob counterclockwise. When it reaches the stop, you have attenuated the signal about 20 dB.

When this isn't enough attenuation, tune your receiver up or down to the first offset frequency. (Examples: 146.565 + 4.0 = 150.565 or 146.565 - 4.0 = 142.565.) Return VR1 to full clockwise, which is the equivalent of about -30 dB, and continue the hunt, increasing attenuation as you approach. By the time you reach 100 dB, you should be within a few feet of the signal source, depending on its power and antenna configuration. Considerably more than 100 dB effective attenuation can be achieved with this unit, but that was the limit of the calibrating I could do with my milliwatt VHF signal generator.

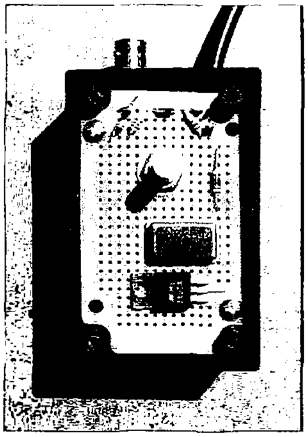


***Photo C.** The circuit board is installed and the input wires are attached to terminal pins.*

This offset attenuator can be used with any VHF transceiver or scanner radio that has a removable antenna. Provisions for attaching to sets with integral antennas (such as the Alinco DJ-C1T and DJ-S11T) are not included. The receiver must have

Continued on page 78

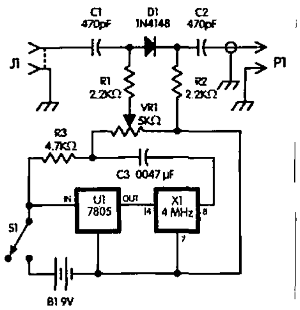


***Fig. 1.** Schematic diagram of the offset attenuator.*

Homing In

continued from page 77

sufficient frequency coverage to permit tuning it 4 MHz away from the hunt frequency. If your handheld does not have an extended range receiver (the Radio Shack HTX-202 is an example), find a lower frequency oscillator module. Radio Shack sells a 1.8432 MHz module (RSU 11321205). It is not easy to quickly add or subtract 1.8432 to the hunt frequency in your head, so calculate and program the proper offset frequency into a memory channel in your handheld before the hunt.

The current drain of this unit is 27 mA, so expected battery life is about 15 hours. CMOS oscillators that have much lower current drain than the Crystek unit sold by The Shack are available, so check other parts suppliers. I found a 2 MHz module at Fry's Electronics that draws less than 1 mA. Another way to improve battery life is to replace U1 with a "low dropout" regulator such as the LM2931A2-5.0. This makes it possible to use nine-volt batteries down to about 5.5 V instead of 7.5 V.

Offset attenuator operation may be degraded on frequencies that are an exact multiple of the oscillator, such as 144.0 and 148.0 MHz. If there is a strong communication or paging transmitter that offsets onto the frequency you are monitoring, you may experience cross-modulation interference. An example would be QRM from NOAA weather radio on 162.55 MHz when you are hunting a 146.55 MHz signal by listening on 150.55 MHz. This effect is worse with odd multiples of the oscillator frequency and oscillators below 4 MHz.

Avoid transmitting through this attenuator. Your antenna will emit strong spurious signals and you may burn out D1. Set the power output down to the lowest possible level on your handheld. Fortunately, if you forget and cause a failure, repairs are easy and inexpensive.

There is no isolation between the mixing diode and your antenna. Offset signals not only go into your receiver, but they also go back to your RDF antenna, where they are radiated. This may cause cross-modulation QRM to nearby receivers, even outside the ham bands, when you are very close to the fox antenna.

Remember that an offset attenuator does not greatly reduce the level of on-frequency signal into your radio, so it does not provide protection for your receiver's front end. If you touch your RDF antenna to the antenna of a powerful fox transmitter, you may damage both the receiver and the offset attenuator.

Championships on the horizon

The first International Amateur Radio Union (IARU) Region 2 (North and South America) fox hunting championship has come a big step closer. At January meetings, the ARRL Executive Committee and Board of Directors approved a motion that strongly supports the development of radio-orienteering. It authorized the ARRL's president to appoint an ARDF coordinator for the purpose of promoting this radiosport in the United States, in concert with IARU leaders and member-societies here in Region 2 and in other parts of the world. President Stafford asked me to serve as the first USA ARDF coordinator and I accepted. I look forward to working with ARRL leaders and many "Homing In" readers to increase awareness and participation in ARDF activities all over the country and the Americas.

You can see the entire ARRL resolution and learn more about plans for the 1999 IARU Region 2 Championships by visiting the "Homing In" Web site. Don't worry, this does not change anything about these "Homing In" columns. I plan to continue bringing you news and projects for all kinds of RDF every month in *73 Magazine*.

RTTY Loop

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Tie an inky ribbon 'round the platen, please!

In past months, we have been looking at many high-tech RTTY items, from computer software to the Internet, from packet interfacing to frequency search engines. This month, a giant step into our roots, with a look at teleprinter ribbons.

Several readers have asked about the availability and maintenance of ribbons for mechanical teleprinters.

For example, Stanley Wilson AKØB has been looking for a source of teleprinter ribbons as well as a way to "refresh" a dried-out ribbon.

Casting about a bit, there really are quite a few sources, even today, for teleprinter ribbons. Several mail-order firms stock ribbons for everything from an old Model 15 through the Model 43 and beyond. Be on the lookout for Best Impressions, Global Office Supply, and DARTEK of Naperville IL [http://www.dartek.com/] as possible sources.

Of course, old Underwood typewriter ribbons have always been the traditional replacement ribbon to pick up at the office supply house for your Model 15 or Model 19.

If you have one of the major office supply houses nearby, such as Staples, Office Max, or Office Depot, be aware that, for example, a Dataproducts #R3300 all-black ribbon is available and fits the Teletype® Model 28 series. The Pelikan brand ribbon number Z470 is specified for the Okidata series 80, 81, and 82 dot matrix printers, and is fine for Teletype Models 28, 32, 33, and perhaps others.

Now, just in case someone should try to sell you a bunch of old surplus Teletype ribbons, sealed in a cellophane bag, "just say 'no.'" Cellophane is hardly impermeable, and many such ribbons have been tossed out as dried out and unusable.

There is a question about the relative merits of the traditional cotton ribbons and some of the newer ones, which are often nylon or rayon. With limited usage you won't notice much difference between cotton and the rayon or nylon types, but the nylon/rayon ribbons print much lighter than the cotton ones. Many of the 32s, 33s, and 38s don't provide much of a "smack" for the typewheel to make an impression, so to make up for this, many folks misadjust the mechanism—which wears out the ribbon, typewheel, and print hammer more quickly.

The supplies practice for Bell System Teletypewriters specifies that ribbons used for Models 15 through 37 be made of cotton and be inked from medium through heavy.

Years ago, ribbon wear was evaluated on Model 35ASR machines in use at the Addressograph-Multigraph Co. The question was, just how did cotton ribbons compare to the nylon/rayon type. The results varied by machine and operator, and the number of copies in the forms. However, on average, the nylon/rayon inks would be used up in about two to three weeks, whereas the cotton heavy-inked ribbons would last five to six weeks or more.

If you have an old ribbon (and who running teleprinters doesn't have at least one on the shelf?), you may have thought of trying

to restore it to function. Many folks have tried contact cleaner spray or WD-40® lubricant. A light spray of either, allowed to "wick into" the ribbon, can restore the function for many hours. They do evaporate after a while, though, so you may have to repeat the process. A more standard "rejuvenator" for old ribbons is glycerin. You can normally buy it at your local pharmacy. Just put a few drops onto the edge of the reel, and let it seep in.

On the other hand, you might actually want to try re-inking an old ribbon. While there once were, and still may be available on the surplus market, real teleprinter ribbon re-inkers, several folks have tried some new ideas. There are those who have picked up stamp pad re-inkers and are experimenting with those to re-ink ribbons. Another fellow wrapped one of the ribbon guides on the machine with a piece of felt, then soaked the felt with stamp pad ink, using a dropper.

Apparently the cotton ribbons take more ink but wear out more quickly, while the nylon ones last longer but hold less ink. I guess it's all what you get used to.

My sincere thanks to Stanley Wilson, Don Robert House, Daniel T. Ruth, David Ross, Bill Nelson, Edward Greeley, Jack Hart, Bob Roehrig, Richard M. Gillingham, Steve Rohrer, Bud KV7G, and the others who added thoughts to this thread. I look forward to hearing from you all, as well.

Now, I can't stay away from the more modern for long, so let me respond to a question posed by John Burch WB6GHA (formerly WN6GHA), who wrote:

"I'd like to pose a question to you, based on the unique position that you have which allows you access to so many of the Green Keyers out there ...

"Let's say I had the traditional (before SoundBlaster®) RTTY setup where I had a TU of some sort driving the 'usual' 60 mA loop in which a page printer and maybe a TD (tape reader) or some such were hooked in series, just as God had intended.

"And now it's 1998, and I have this brand new PeeCee 'IBM-Compatible' thing in the shack. I have decided that, in the 21 short months before all of the world's computers die from the Y2K problem, I want to hook this PeeCee thing in series with the loop that 'runs' the rest of the RTTY gear here in the shack.

"Setting aside for the duration of this conversation all of the issues of interfacing the PeeCee to the loop, I know that I will need some sort of software to allow the PeeCee to both send and receive.

"My question to you is this—what are the more popular programs out there to perform these functions?

"I'm most interested in programs that are still available and hopefully 'supported' or at least well documented.

"The number of additional features such as multiple type fonts and three-language spelling features are not that important.

"Of particular interest would be your recommendation of those programs to *stay away from* for whatever reasons!"

Well, John, there are any number of programs which are around and can fill your needs. There are simple programs like TRTY and AutoRT, both of which are on the first disk of the RTTY Loop Collection and can run RTTY with a plain terminal unit and simple interface to the computer. Many hams have used HamComm with quite a bit of success, and there are other programs like RAFT and RTTY12G which will also run with only an external terminal unit. The nice thing is that all of these programs are easily available, either on-line at various sources or as part of the RTTY Loop Software Collection. Check the RTTY Loop Home Page, at [http://www2.ari.net/ajr/rtty/] for the complete listing of software available, and follow the simple directions to obtain a program disk. Readers without Internet access can send a self-addressed, stamped envelope to the snail-mail address at the top of this column for a printed listing and instructions. I try to include new finds as they surface, so stop back every now and again and have a peek.

Next month, more of interest to you and me, as we continue to look at this unique facet of amateur radio and this column completes its twenty-first year of publication!

LETTERS

continued from page 6

woods, trying to get the "code codgers" to help upgrade skills is nearly impossible. They'd rather sit and talk about the "good old days" and whine about how terrible everybody else is. I am fortunate that my club does have a pretty strong group that does help out. We have a group of 20 or so that are all hard at work upgrading our skills thanks to the folks willing to help out. (3) I don't know how to respond to your complaints about the ham who wants to *really* talk to the guy on the other end of the radio wave. I thought that this hobby was about communicating with people. If the two parties want to rag-chew about their kids, who the hell are you to feel put upon? Spin the dial and find someone else to talk to if all you want to do is exchange callsign and RST.

Wayne, I'm glad that folks like Doc are a minority. As I've learned code, built my antennas, installed equipment and operated over the last year, I've met nice supportive folks on the bands (particularly the CWers). I had only one guy throw up his "hands" with my code about a week after I got my Tech Plus. Heck, I didn't blame him a bit. I was terrible! But all those many people that stuck with me are appreciated and you can be sure that I'll be around to help others getting started. When the hobby gets so frustrating that I have to snivel in a national magazine, I'll find something else to do.

Ed. note: We published the "Letter From Down East" as a humorous piece, but ...

Howard White VE3GFW. Here's a letter I wrote to *QST*. I doubt they will print it.

"Dear Sirs: I have been a life member of the American Radio Relay League for more than 25 years. I recall that ham radio was once the leader in technological innovation. Because of this leadership, it was the beginning of my interest in electronics in the 1950s. In the last few years, my own interests have been in the applications of computer systems and my interest in radio has for the most part been supplanted in the mid-1960s by more innovative technologies.

"I must admit that I have not been involved much in ham radio very much since the invention of the cellular telephone took away my spare time in my automobile. For the first time in a very long time, I picked up a copy of *QST* and actually read it. I was appalled to see that *QST* had a feature article on how to make a Morse code key.

"Wake up and smell the roses! Morse code keys? You've got to be kidding! Why not horse & buggy whips or spark gaps? No wonder ham radio is dying as a hobby. Your article on Morse code keys was followed by a very basic article on how to put together a computer. That article is only 20 years too late.

"If you guys are supposed to be the leaders of ham radio's charge into the 21st century I guess that I should dig a hole and bury my rig. What a pathetic showing! How about articles on things that are relevant to the modern world. Spread spectrum? Low orbit satellites? Internet interfaces? How about articles that might excite youngsters to get

Continued on page 80

Letters

Continued from page 79

interested in electronics like ham radio did for me in the 1950s. But Morse code keys! I am embarrassed to be associated with you. Need I say more?"

John R.C. Crabtree, Edina MN. I could not agree more with your editorial on the ARRL as a publishing company. While it is admirable that they are a source of technical information, I find several aspects of their modus operandi to be infuriating:

1. I have a feeling that they are trying to sell as many books as possible. Any publishing company would. To this end, they keep referring you to another book. How many times have you seen in the *ARRL Handbook* words to the effect that further information can be found in "xyz" book? Understandably, many of these other books are not readily available at local libraries.

Right now, too many of their titles are still in print. For example the better material from the five "Antenna Compendium" books should be incorporated in the *Antenna Book* and the earlier volumes allowed to fade away. The latest version of the catalog no longer shows the original publication dates!

2. The idea of being a publishing company leads to a new *Handbook* each year with minor changes. The ARRL is as hung up as the auto companies, in wanting a "new" model each year. The RSGB is now on the sixth edition (too few) of its handbook which was first published in 1938. Every three years should be fine, but it would, no doubt, mess up the ARRL revenue stream.

3. I am insulted by the comment which I found in the second printing of *Solid State Design for the Radio Amateur*. In the foreword it says "In this second printing, the occasional errors and omissions which inevitably creep into a work of this magnitude have been corrected, making the publication more valuable to its intended audience."

Does this mean that I should not buy the first printing of any ARRL publication? Am I supposed to accept that their books contain errors, and then have to work them out for myself?

4. Some of the editing of these books is atrocious. I understand from a post by Bill Sabin, WØIYH, to one of the [rec.radio.amateur.homebrew] [postings] that authors are not paid for updates to their chapters. I quote from his post, "I had a very similar experience with Chapter 17, which I try to update a little each year (no payment)."

This places an even greater responsibility on the ARRL editors to do a thorough job. Otherwise mistakes can get passed from year to year. For example, equation 5 on page 10.7 of the 1998 *Handbook* is incorrect and does not agree with the text. The same error is in the 1995 *Handbook*. In other parts of the book they have not always followed their convention in putting references to the figures in bold type. Book references have not been checked and updated. In section 30.5 they do not give the address of Rockwell Collins, cited in Chapter 17. In the same section, they ask for updates to be sent to the ARRL. Why are they not checking this stuff and finding out details of the Web sites too? 73

Joy's "Loud Enough" Metronome

continued from page 27

for 15, 30, or even 60 seconds. Apply the correction factor. Multiply the number of pulses by four, two, or one, to get the number of beats per minute. Then mark the scale on the box.

For the simple, basic bare-bones model, this may not be too bad. If you want a slightly more accurate model—one with presets—see if you can find (a friend with) a frequency counter. Most of the benchtop models will have a "period" function. That will let you measure the time between pulses. **Table 5** gives the number of beats per minute for the period or the time between pulses. It also contains the 34 standard tempos.

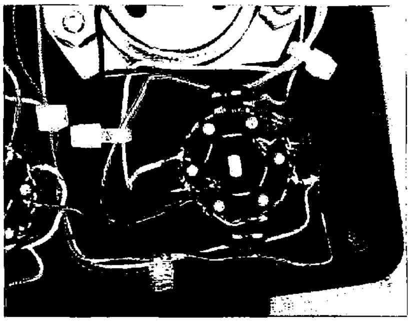


Photo G. Close-up of function select switch in deluxe model.

At this point it looks like we could use some words of explanation about the differences between **Table 4** and **Table 5**. **Table 4** up through the 220 mark represents the standard marks as often listed in textbooks. I added the other two marks in order to fill out the 36 positions on the three switches. **Table 5** lists the marks I wanted to use in Joy's deluxe version, but a close look at **Photo D** will reveal that in actuality I ended up using a combination of marks from both tables. **Table 5** also shows the settings for the frequency counter if you use one to adjust the timing.

Making your mark

On one of the early iterations, **Photo B**, I used a felt-tip marking pen: crude, but effective. That explains why you cannot see the top of the box. A plastic embossing tool will give durable marks, as will an electronic labelmaker. This last option will let you make small enough labels if you want to crowd several marks together. On the variable control, the timing marks get crowded near the high end. A metronome with presets will allow uniform spacing between timing marks.

Using the metronome

While I can give you information on how to make a loud enough metronome, I will have to suggest that you check with a music teacher for the specific techniques used to get your own timing where you want it. Maybe with one of these "loud enough" metronomes, you can do it.

I have been getting assistance from Joy. One of these days I hope to pick up the flute and get the timing right myself, so that she will quit telling me, "No, Dad, that's supposed to be one and, two and, three and ..." 73

NEVER SAY DIE
continued from page 31

show this FCC mandated tax on their phone bills so you'd be aware that you've been taxed. The FCC balked, with the final agreement being that business customers will have the tax itemized on their bills, but not residential customers: you.

The motives for this FCC-sponsored social legislation may be worthy, but that doesn't make it either ethical or constitutional for them to impose a tax on us for this social service. This is just one more hidden tax that we're all going to have to pay. If schools want more computers I've proposed in my past editorials a practical way for them to get the latest and greatest computers for almost nothing.

In another vigorous bending of the rules, the FCC has decided that passive radar jammers are illegal. Yep, they've decided they can regulate not only the transmission of radio waves, but reflected waves, too. And their "laws" are, practically speaking, unchallengeable since they have unlimited funds to prosecute (persecute?) offenders.

As a practical matter, please keep the above to yourself. Since we hams exist only at the sufferance of the FCC, we don't want to bite the hand that's feeding us. Unfortunately, I've a long history of vigorously biting the hands that feed me — when I think they need biting.

Communicating With Plants?

Okay, okay, so I've read another book. Well, the ad for it was intriguing in the Dowsers catalog. It's Bennett's *How to Communicate With Plants and Animals*. Having read *The Secret Life of Plants* by Chris Bird many years ago (it's reviewed in my *Guide*), which provided convincing proof that people and plants can communicate, and also having read and recommended *Kinship of All Life* by Allan Boone, which explained how anyone can learn to communicate with animals, I just had to spring for the $4.50 for this new book. Money well spent.

I've explained how I used Boone's system to communicate with flies. Before that I'd had to have fly swatters in every room during the summer. In the three years since reading the Boone book I haven't had one single fly come into the house.

I haven't told you that I used the same system with ants. Before that there was a yearly trail of ants checking out not just the kitchen, but even into the bedrooms. Not one ant in three years now.

So I wanted to see what system Bennett used to communicate with plants and animals. His approach is different from Boone's. Bennett uses dowsing rods. With them he explains how you can find out whether a plant needs more or less water, how it likes its soil, and even if it prefers to face a different direction. Is it comfortable with the sun it's getting? Is it too cold or hot?

In some way your pets are tuned to you. Many owners find their pets right there waiting for them when they come home, no matter the time. And there are endless stories of pets who have tried to get their masters not to make a trip where they were going to have an accident. And pets somehow know ahead of time about earthquakes. Bennett's system will allow you to communicate with your dog or cat.

He doesn't go into it, but remembering the Bevy book *Psychometry,* I'm sure you'll learn how to communicate with things like trees, rivers, and even rocks. Go ahead and say it, Wayne's off his rocker. I don't mind, as long as it doesn't stop you from getting the book and giving the dowsing rods a try. You can make a pair from a couple of wire coat hangers.

You can get the book from the Dowsers Bookstore, (800) 711-9497. Tell 'em Wayne sent you so maybe they'll give

me a discount on a bunch more of their books I'd like to review. If you can read through their catalog without buying at least 20 books it's time for you to get a mind-Roto-Rooting™. Ditto the Acres USA catalog, (800) 355-5313.

Magnets

I've reviewed a couple of books by Rawls and Davis on magnetism, and I've included them in my *Guide*, but that hasn't been enough to get you out of "park" and even into neutral, much less first gear. Well, here goes again. I've just read Rawls & Davis' *The Magnetic Effect*, Acres USA, 128 pp., 1975, $15. It's #701 from Acres USA at (800) 355-5313.

Not only does a magnet substantially affect the growth of seeds and plants, it also can be used for healing a wide variety of illnesses. You use a bar, not a horseshoe-shaped magnet, so you can isolate the effects of the north and south poles. You see, the north pole tends to slow growth and the south pole to increase it. For instance, in the case of cancer you want to stop the growth. A south pole will speed up the healing of cuts and burns. It's almost like magic.

Even more remarkable, you can magnetize water and see the difference when you use it on seeds and plants. Once you read about it you'll be doing as I do and putting the north pole of a magnet under your bottle of distilled water before you drink it. Kids may want to set up a simple science fair project with seeds watered by north and south pole waters, and compare their growth with unmagnetized water for the control plants.

I don't want to give everything in the book away. By reading it you'll know more about magnets than 99 out of 100 scientists. And you'll see why I've been pestering Don Lorimer (Mr. Magnets) to get busy and write a 1998 book on the subject.

DEET Can Kill!

Hey, I've been warning you about insect repellents and how they can be absorbed through the skin. Just because water doesn't go through easily doesn't mean that a lot of other much more dangerous stuff won't. Try daubing on some DMSO and smell your breath a few minutes later to get a hint.

Anyway, the American Academy of Pediatrics has warned us not to use any products with DEET™ in them on kids under five. In 1995, 64% of the people reporting serious side effects to insect repellents were under the age of six. One man of 34 was killed by DEET. An ABC-TV documentary reported a 26-year-old man dying after two sprays with DEET. An eight-year-old boy suffered seizures.

Be as careful about what you put on your skin as you are about what you put in your mouth. I listed some of the ingredients in *OFF!*™ a while back. And then there is all that aluminum in deodorants. Just what you need to help with your potential unmemorable Alzheimer's trip to a rest home as a veggie tied to a rocking chair for a few years. Say, have you bothered to visit a nursing home recently? It might even get you to start considering making some diet changes. But I doubt it.

Fox Hunting

The Garden City ARC newsletter mentioned that they are running fox hunts once a month. I wonder how many clubs are doing this? I sure don't see much of a sign of it in the club newsletters I'm getting. Yes, I read the newsletters.

How about some letters or articles for *73* on fox hunting? Maybe you've had some interesting adventures? Found some unusual places to hide the fox? Are your members doing all their hunting from cars or are you making them get out and walk? I think the US is the only country where much of the fox hunting is done in

cars. Hams in most countries are out there on foot. It's good exercise for some of you pork-bellied hams.

What equipment are the winners using?

Have you considered doing some videos of your hunts? I'd love to see some. I'll never forget a Philmont film which showed them hiding the fox in the women's toilet of a police station, with the coax going out the window, under a lake to the antenna mounted under a little bridge. The hunting cars drove over the bridge, with their antennas twirling to keep on target.

Ham clubs are desperate for entertainment, so if you can whup together some fun fox hunting material and make copies available, I think you'll get a lot of good PR for the club. You might even find other local clubs interested in seeing it too, like Lions, Elks, Chamber of Commerce, Rotary, etc. Heaven knows amateur radio can use the publicity.

Shot Causes Autism!

Five recent studies show that the measles-mumps-rubella (MMR) vaccination can cause autism and Crohn's disease in children. Is that a gamble you're willing to take with your kids and grandchildren? These are not very dangerous childhood diseases which, if allowed to happen naturally, will protect the kids from getting these diseases later on, when they can be much more serious. I had the measles at four and the mumps at 10. Both made me sick for a few days. The only thing I remember about the mumps, when we were living in Washington DC, was watching the airplane flying over and describing on the radio FDR's inaugural parade in 1933 from my bed. A radio broadcast from an airplane was unusual in those days.

Well, you probably say, since you are annoyingly argumentative, at least the vaccination will protect you from these diseases when you're an adult. Oh yeah? A recent outbreak of measles in Greece put 79 adults into the hospital and 76 of them had been immunized.

The fact is that any vaccination can have long lasting unforeseen results. But can I get you to read Wallene James' book on the subject? Not when there's a Broncos game or something on, for sure. Yes, the book is listed in my *Guide*.

Skin Cancer

Dr. Lorraine Day, in a fascinating interview on the Art Bell show, cited a Baylor University animal study where one group of rats was fed the standard American diet of junk food and a second group was fed a nutritious diet. Both groups were exposed to high intensity ultraviolet light. Twenty-five percent of the animals eating sugar, white flour products and meat developed skin cancer. None on the nutritious diet did. None. And that backs up the information in the books reviewed in my *Guide* by Ott and Lieberman, and the advice from Dr. Douglass, in whom I have a lot of confidence.

Dr. Day went through the standard medical education, which concentrated in treating symptoms, not the causes of illness. And then she came down with cancer. It came within days of killing her. If you think I'm exaggerating you can check the photos of her with a grapefruit-sized tumor via Art Bell's Web page [artbell.com]. There's also a photo of her after she cured herself by rebuilding her immune system.

Her prescription, I was delighted to hear, is exactly what I've been preaching. She cut out all sugar and white flour products, and poisons such as coffee, cigarettes and alcohol; she drank around 20 glasses of water a day; got lots of sun on her body and into her eyes; exercised; and did her best to eliminate stress. She ate raw fruits, raw vegetables, and grains. No milk products. No meat. No hot fudge sundaes.

If there's any part of that list that you want to argue with, please check my *Guide* for a book which goes into details on that subject.

I've been recommending eight glasses of distilled water a day, but she drank 20 glasses a day as a way to rebuild the ability of her body's cells to absorb and hold water after having been shortchanged for many years. Good plan. Yes, it does have you going to the bathroom pretty often.

The lifestyle change it takes to keep from getting sick and dying early is a major one. Having made it myself, I can understand why many (most?) people prefer to get sick and die.

Will Art Bell W6OBB be able to change his dependence on coffee, cigarettes, alcohol and hamburgers? He's 53 now, so all this could catch up with him pretty soon.

Nag, Nag

A *British Medical Journal* report of a long-term (17-year) study showed that eating fresh fruit daily substantially reduces the risk of death. Those eating fresh fruit daily have a 32% lower rate of death from strokes, 24% from heart disease, and a 21% lower rate from all other causes compared with those eating fresh fruit less often. Dr. Douglass (of *Second Opinion*) recommends we eat three apples a day. I eat at least one orange and banana a day, two or three apples, and some grapes or a grapefruit.

A Cambridge (*Lancet*) study showed a 77% reduction in new heart attacks when a 400 or 800 IU vitamin E supplement was taken every day. Two hundred milligrams or more of vitamin C daily also lowered the risk of other illnesses. I take 1000 a day. Many studies show that daily exercise increases longevity and greatly improves the quality of life later on. I jog a couple miles most days, but I should do it twice a day.

Then there's a *British Medical Journal* report showing a direct relation between hip fractures and smoking. Smoking somehow acts on the bone minerals, decreasing them by 2% for every 10 years one smokes, which probably explains why my father broke his hip after a small stumble at home when he was 70. He smoked Camels and died of emphysema, after living (sort of) several years connected to an oxygen bottle.

Great Minds

Great minds tend to run in similar ruts, so I was delighted to see a column by Thomas Sowell on what he would do if he were president. If there ever is a demand for someone with serious brains for the job, Sowell would make a good candidate. One of his books is recommended in my *Guide*, and I probably should add a couple more. Anyway, one of the moves he says he'd make as president would be to make it so all politicians could serve for one term only. This is what I had in mind when I proposed that we adopt NRA as our strategy: Never Re-elect Anyone. Get the pros out of our government. This would eliminate all that re-election campaign fund soliciting corruption and pretty much kill the lobbying business.

Sowell would also shut down all schools of education (teachers' colleges). My *Guide* recommends Sowell's *Inside American Education* and Kramer's *Ed School Follies* for anyone who doesn't know what a ghastly waste of time and money ed schools are. Sowell says he'd pay every ed school professor a million dollars to stop teaching and stop writing. He says that would be the greatest bargain we've ever gotten from our educational dollars.

While I like the idea, my approach would be different, with our schools being changed to the Sudbury Valley School system. Read *Free At Last* by Greenberg for the lowdown on this kind of school. It's turning out amazing graduates, and at less than half the cost of our public schools. Yes, it's reviewed in my *Guide*. And once you read that book, you'll want to do as I did and get the other seven books about this phenomenal

Continued on page 84

NEVER SAY DIE

continued from page 83

school — and then maybe start one like it in your area.

Hmm, That's Odd!

With the approaching millennium I've been reading some articles on the technology wonders of the 20th century. Like the transistor, which has resulted in incredible changes in communications, entertainment and computers. This remarkable discovery resulted in three Nobel prizes.

Wow, great for us, right? And great for AT&T, in whose labs the transistor was developed. But there's a teeny, tiny fly in that ointment. If you've read anything at all about research funding you know that in order to get funds a researcher has to virtually prove that the results will be as predicted. Yet here we have a case where three of the world's top scientists were suddenly funded on what could easily have been a wild goose chase. Not bloody likely.

More likely is Col. Corso's version, where he went to AT&T with an artifact from a crashed UFO and gave alien transistorized equipment to AT&T to try and find out what in the heck it was and how it worked. Actually, he says he took alien integrated circuits to them. This would explain the sudden crash program and the unheard of assignment of three top scientists to the project.

Corso was the officer at the Pentagon put in charge of foreign technology, so the recovered UFO equipment ended up at his office for a quiet introduction via military suppliers into the development of new products.

Corso claims he introduced transistors, ICs, lasers, night vision systems, and other advanced technologies.

Why the secrecy? Well, it makes sense that the Air Force was not eager to let the public know that they (we) were faced with aliens with vastly advanced technologies. Talk about panic! They wanted to do their best to catch up with the aliens so, if they turned out to be hostile, we'd at least have a chance.

Are Alien Implants Rubbish?

I'm not sure what it takes beyond a White House bimbo eruption to get the attention of the media, but I recently got a video showing Dr. Roger Leir removing tiny implants from a number of people — and then later listened to an interview with the doctor on the Art Bell (W6OBB) radio talk show. Quite a few people with abductee stories also have been found to have implants, some inserted when they were as young as four — usually in a hand, foot or toe.

If you think the abductee biz is just another *National Enquirer* bunch of hokum you haven't bothered to do any homework. Like at least read the Mack book on the subject (yes, it's reviewed in my *Guide*). This Harvard psychology professor decided to investigate what he considered aberrant behavior. It didn't take long for him to decide that abductions were real. It's a fascinating book and detective story.

The removed implants are of several kinds, with some showing evidence that they have microcrystal circuits in them which could be some sort of transponder. They are encased in a membrane which a surgeon's scalpel can't cut, but which is not rejected by the body. The substance is unknown to scientists, but if replicated could be of enormous value to surgeons. That is supposing that Dr. Leir can get anyone else to even look at them.

Maybe the conspiracy paranoia is catching, but right after I watched the implant video three things happened. Curious coincidences. One was that the video totally disappeared from my living room and has never shown up again. Two, I suddenly found an unexplainable little lump on my hand, between my thumb and forefinger. I've never had anything like that before and it's still there. Three, a friend who was visiting said that that night a black helicopter flew low over the house. He felt something was wrong about it so he drove down to New York a few days later, where an expert found and removed two implants from him.

Weird stuff. But, you know, the next time I'm at the hospital I'll ask 'em to X-ray my hand to see what that might be in there. Just in case.

A *Challenger* Conspiracy?

If the *Challenger* disaster was an accident, then why is NASA still covering up some key information? Damning information?

No, I don't sit up all night listening to the Art Bell show on AM radio, but I do tape it every night on my VCR. All five hours of it. In that way, when I'm doing routine no-brainer work I can listen, fast-forwarding through the commercials. That cuts the program down to more like two and a half hours. Skipping the random unscreened calls from listeners and listening mainly when he has interesting guests saves me even more listening time.

Anyway, while collating the pages of the reprint of my editorials for January through April 1998, my conspiracy theory flag went up when Art interviewed Ted Triedmeier, the chap who installed and was in charge of the data switching systems at the NASA launch sites. He explained that he'd installed a sophisticated system which monitored just about every conceivable aspect of the launches. The controls for the system were at the launch site, and thus required special clearance for anyone to access them.

On the *Challenger* launch he found that someone had, shortly before the launch, accessed the site and turned off the master switch for recording the launch data. This switch was protected by a cover so it could not be accidentally operated.

Ted pointed out that even a slight change in the timing of the release of the bolts holding the rocket down would have put a severe lateral strain on the engines, which were made in separate pieces, held together by the O-rings. A slight reprogramming of the bolt release sequence could have caused the ensuing catastrophe. But that would have shown up on the data record ... if the telemetry system had not been turned off.

NASA, according to Ted, was made aware of all this, but has never released any information on who turned off the telemetry or why. Or, for that matter, why the telemetry shutdown didn't stop the launch, which was what should have happened automatically. That safeguard, too, had to have been compromised.

There doesn't seem to be any non-conspiracy way to explain this, so what in heck has been going on at NASA (Never A Straight Answer)?

That Face

So there's this hill on Mars that, in a certain light, looks something like a face. Big deal. Big supermarket tabloid deal. Big Richard Hoagland deal, if you've heard him carrying on at great length about it. Serves me right for listening to him on the Art Bell show.

Hoagland puts Mel Gibson to shame as a conspiracy theorist. He believes there are cities on Mars and the Moon which are being covered up by NASA. Somehow he ties this together with the Masons. My father and grandfather were both Masons, but neither of them ever mentioned anything about the organization to me, so I guess I didn't measure up. But then I've never been a big joiner. I've managed to somehow not get involved with the Lions, Elks, Rotary, and so on, other than giving talks to these groups. Well, I did get involved with the Chamber of Commerce and quickly got to be the president (Peterborough).

Come to think of it. I've been made the president of most of the groups I've joined. Hmm. I digress, as usual.

Getting back to the so-called face on Mars. If, as NASA claims, there is nothing to it, then why have they announced that the latest satellite circling Mars will have its camera turned off while it is over the Cydonia area where the face is? Well, that's what NASA's Dr. Michael Mayland said. Now *that's* weird.

I can understand that NASA might say the camera would be turned off, but I'll bet it won't be. Thus, if they find clear signs of a current or past civilization they might want to keep that quiet.

Why? Because that would put on the pressure to send astronauts to explore it, and NASA, I suspect, knows that there is no way with our current technology to get anyone into space safely beyond the Van Allen belt. Moon rocks they could fake, but not the exploration of a city on Mars.

Or am I being caught up in the conspiracy theories too?

You, too, can really upset the believers in NASA and our having visited the Moon by reading René's *NASA Mooned America* and quoting his data.

Bombing Iraq

The Administration, aided mightily by our beloved media, have been whooping it up about Saddam's biological weapons, with few voices of moderation being heard. Yes, it would be awful if Saddam unleashed anthrax in a New York subway.

But even more in danger would be his neighbors. You know, like Iran. Saddam hates us something fierce, but I suspect that he hates Iran even more, and they're a lot closer and easier to deal with. Yes, even in the heat generated by the Administration over the blocked UN inspections, we weren't hearing about any serious concern from the other Arab countries. Oh, Kuwait sided with us (the only Arab country to do so), but then we saved their leaders' bacon (pardon the expression) eight years ago, keeping those despots in power.

What didn't get much coverage were the other countries strongly suspected of having biological weapons. You know, like our friends Iran, Libya, North Korea, Syria, China and Vietnam. Plus Russia, India, Egypt, South Korea and Taiwan.

Sure, there's an international agreement not to develop such weapons. But then we hear that the US has, despite the agreement, been designing, making and stockpiling the stuff for years in secret. And so has everyone else.

It's easy to make the stuff. You've probably seen the *60 Minutes* segment showing that the US sold Saddam anthrax and bubonic plague germs, all with not just the okay, but with serious pressure from our State Department to make the sales. It only takes a small area to make as much of this stuff as you want, so it can be made anywhere and quickly moved, if an inspection looks likely.

Delivering the stuff effectively isn't easy since daylight kills most agents, so it might not be as serious a threat as a revival of the Spanish Flu.

So, are we going to bomb the Chinese biological weapons plants (presuming that we can find 'em)? And how about all the others?

A recent article in the March 9th (1998) *The New Yorker* quoted the top Russian bacterial warfare scientist, who is now working for us, as saying that when the USSR fell apart the funding for bacterial warfare projects dried up, so he and the rest of the scientists involved headed for the countries offering them employment, taking along some starter viruses and germs to help get things going.

He told about their working on these agents in space suits and that one day one scientist had a needle prick his finger through the glove. He died a few days later oozing blood from his entire body. They have this stuff so it is microencapsulated to stay alive in the air and be carried by breezes for miles. Once you inhale the air you're done.

With normal anthrax it takes about 8,000 spores in the lungs to guarantee death. With Marburg Variant U anthrax it only takes one to five spores.

Other agents are Black Death and powdered smallpox. Now they've combined Ebola with smallpox to make it even more deadly.

Well, I thought you might like to know. Look up the article in the library if you're not a subscriber.

Korean Tunnels

My Congressman, Charlie Bass, gave a talk on his recent visit to North Korea. For some weird reason the first US delegation invited to visit this country was the House Intelligence Committee, so Charlie was there, armed with a video camera.

The camera was a good idea. If we hadn't seen his pictures to back him up, we'd have suspected he was exaggerating.

I read a lot, but I don't recall any reports in the media on what things are like in North Korea. The bottom line is: They're incredibly awful. The capital, Pyongyang, is almost a deserted city. There are a few people wandering around, but they are there for show only and have nothing to do. No one is allowed into the city from the rest of the country. There is no electricity anywhere in the country except in the president's palace. Charlie showed me a night satellite photo of the Korean peninsula, with South Korea ablaze in light, and plenty of light in China, but North Korea was totally black except for one light from the palace. With no electricity there are no radios or TVs. No telephones, no Internet, no faxes. There is no oil for lamps, either.

The people are not allowed to congregate and talk in any of the towns. They have to stay in their homes when they are not working in the fields. They used to gather around the town well, getting water. Then the government put in pipes to bring water to their homes so they wouldn't be able to gather at the wells.

Food is so short that the people are getting just a few hundred calories a day of rice and are slowly starving.

No small businesses are allowed.

One thing the North Koreans have been doing is secretly digging tunnels under the DMZ, presumably in preparation for invading South Korea. With Seoul only a little over 20 miles from the DMZ, there's considerable uneasiness about this. There are barricades set up over all of the major highways leading into Seoul, complete with explosives to quickly put the barricades into place. They had those set up when I visited the DMZ a few years ago.

I was lucky in that the head of the UN forces at the DMZ was a Danish ham and I was able to get on the air from his station. Hey, does that count as a new country, like those old 8Z Arabian neutral zones?

One of the big problems, Charlie explained, is that we don't know exactly where all of the North Korean tunnels are. I'm going to have lunch with him in a few days and explain how we can find this out, and then propose what can be done about it.

Ask me how we can locate a bunch of underground tunnels. Radar? Sonar? Nah, if you've been reading my editorials attentively as you should, you'd know the answer already. I wrote about this recently.

On page 11 of Chris Bird's *The Divining Hand* is the story of the famous Paris test in 1913, where dowsers precisely located a group of underground tunnels and old mines in Paris, some not even charted. A good dowser should be able to locate every North Korean tunnel and find its exact depth. And if it's too dangerous to walk around the

Continued on page 86

NEVER SAY DIE
continued from page 85

area, the dowser can do just as well with a good map.

Once located, what should be done about the tunnels? My idea would be to set up a drill and put a pipe down into each of the tunnels. Maybe a four-inch pipe. Then I'd collect a few hundred thousand gallons of pig manure and start pumping it into the tunnels until they're full. If they run short of manure in South Korea I'm sure the good people of Georgia will be glad to ship over a few tankers of the stuff they have collecting around their big commercial pig farms. Maybe you saw the fuss over the pollution and stink on the *60 Minutes* segment.

This might turn the DMZ into De Manure Zone.

If the North Koreans complain we could explain that we are just re-fertilizing the ground.

Sometimes there are better weapons than guns and bombs. Sometimes it's better to outsmart an enemy than to outfight them.

The main problem is that the people of North Korea have no way to get rid of the government that is holding them prisoner. They are watched so carefully that they can't revolt, so there can be no uprising. They're too weakened by the food shortage anyway, and they have no means of communications with each other. Not even talking.

Their government has been busy selling missiles to Iran. They explain that if we want them to stop doing this then we'll have to buy their missiles, paying for them with food.

Huggable Wayne

At hamfests hundreds of hams come up to say hello and they don't just shake hands, they hug me ... and I love it! I love it because I know that the odds are that these are people who are healthier, wealthier and happier as a result of my editorials. The hand-shakers are people who enjoy my editorials, but haven't yet let me change their lives. The obese and smokers generally sneak by, avoiding eye contact.

Can I get you to stop poisoning yourself with sugar, coffee, alcohol, nicotine, and dental mercury? Can I get you to exercise every day, reduce your stress, and drink large quantities of distilled water? The results are worth it and you'll be in line to hug me at Peoria in September. You *are* going to come and see me at Peoria, aren't you? The hamfest is September 19–20th and I expect you to make a major effort to be there, armed with questions.

Yes, I'm playing the same health-wealth tune I lay on you every month. Hello, is anybody home?

SPECIAL EVENTS
continued from page 39

PHILADELPHIA, PA The Olympia ARC will operate WA3BAT 1300Z May 2nd–2200Z May 3rd, to commemorate the 100th Anniversary of Admiral Dewey's triumph over the Spanish Fleet at the Battle of Manila Bay. SSB/Phone—3.898.5, 7.248.5, 14.248.5, 21.368.5, 28.368.5. 145.270 FM; CW—7.030/.110, 14.030, 21.040/.110, and 28.025. For a certificate, send QSL and a 9" x 12" SASE to *Olympia ARC, Independence Seaport of Philadelphia, 211 South Columbus Blvd., Philadelphia PA 19106 USA.*

MAY 8–9

MIDDLEBOURNE, WV The Tyler County Amateur Radio Organization will operate KC8GXI 1400 UTC Friday May 8th–2200 UTC Saturday, May 9th, to commemorate the Tyler County Historic Museum Open House. Phone 3.860, 7.230, 14.270 and 28.320. For a certificate, send QSL and 9" x 12" SASE to *TCARO, P.O. Box 287, Middlebourne WV 26149 USA.*

MAY 9–10

OREGON QSO PARTY The Central Oregon DX Club, K7ZZZ, will sponsor the 1998 Oregon QSO Party 0000Z May 9th–2400Z May 10th. Suggested frequencies: CW—1.810, 3.540, 3.735, 7.035, 7.125, 14.035, 21.035, 21.125, 28.035 and 28.125. **Phone**—1.855, 3.905, 7.280, 14.280, 21.380, 28.580. **VHF**—50.125, 145.025, and 146.550. **No** repeater QSOs. Awards logs by June 30th to *Oregon QSO Party, c/o C.O.D.X.C. K7ZZZ, 19821 Ponderosa St., Bend OR 97702 USA.* Please contact this address for rules and enclose an SASE.

MAY 16–17

OAKHURST, NJ The Ocean-Monmouth ARC will celebrate a Marconi special event at one of the original antenna sites used by Marconi. Station **N2MO** will operate 1400 UTC May 16th–1400 UTC May 17th, on 80–10 meters in the General portion of the bands in SSB and CW. QSL with SASE to *OMARC, P.O. Box 267, Oakhurst NJ 07755 USA.*

MAY 23

HUNTSVILLE, TX The Sam Houston Radio Society will operate Club Station W5SAM from 1300 UTC–2200 UTC Saturday May 23rd, from the site of the statue of Sam Houston, beside Interstate 45 at Huntsville TX. The statue is visible for five miles and is the world's tallest statue of an American hero. Operation will be on or near 14.240, 21.300, and 28.495. For a special QSL, send QSL and business-size SASE to *Sam Houston Radio Society, 407 Elkins Lake, Huntsville TX 77340 USA.*

SUMTER, SC The Sumter ARA, in conjunction with the 55th Iris Festival in Sumter, will operate Special Event Station W4GL, 0400, Saturday, May 23rd–1600 UTC Sunday, May 24th. Stations contacted may request a certificate by sending a 9" x 11" manila envelope to the *Sumter Amateur Radio Assn., P.O. Box 193, Sumter SC 29151-0193 USA.* Contact person is *Steve Heriot KC4ZLB, (803) 773-2282.* W4GL will operate in the General portion of the amateur radio HF spectrum.

MAY 25

CANFIELD, OH The 20/9 ARC will celebrate Canfield OH's Bicentennial on Memorial Day, May 25th, by operating station K8TKA from the War Veteran Museum in Canfield. Operation will be 1300 UTC–2200 UTC. 40 meter phone on 7.260 ±5; 20 meter phone on 14.275 ±5. For a certificate, QSL with an SASE to *K8TKA, 2895 Penny Ln., Youngstown OH 44515 USA.*

JUNE 6–7

BOWLING GREEN, KY The Western Kentucky DX Assn. will operate KB4ALC from 0001 UTC June 6th–2359 UTC June 7th, in celebration of the annual Corvette Homecoming in Bowling Green. Frequencies: 7280, 14280, 21380, and 28480. Stations contacted may request a certificate by sending a QSL to *Kenneth E. Newman KB4ALC, 505 Emmett Dr., Bowling Green KY 42101.*

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Who knows, you may even see one of your photos on a cover of *73 Magazine*! Call Joyce Sawtelle at 800-274-7373 to get a copy of "How to Write for *73 Magazine*." Then, send your stuff to *73 Magazine*, Attention: Joyce, 70 Route 202 North, Peterborough, NH 03458.

Number 87 on your Feedback card

Propagation

Jim Gray W1XU
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

MAY 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
					1 F-G	2 G
3 G	4 G	5 G-F	6 F	7 F-P	8 P	9 P
10 P-VP	11 VP	12 VP-P	13 P-F	14 F	15 F-G	16 G-F
17 F	18 F-G	19 G-F	20 F	21 F	22 F-G	23 G
24 G-F	25 F	26 F-G	27 G	28 G-F	29 F-P	30 P
31 P						

May might not be a very exciting month for DX propagation, because of the approaching summer solstice, although there may be some days very favorable for sporadic E propagation.

The four days surrounding the 11th, as well as being poor for propagation, may produce violent geophysical effects such as volcanic activity, earthquakes, and severe windstorms.

10–12 meters

You may expect occasional short-skip openings from about 500 to 1500 miles. There may be rare openings to greater distances, but not regularly.

15–17 meters

You can expect some reasonable short-skip propagation out to 1500 miles or so, and occasionally greater distances, particularly transequatorial DX skip—with sometimes surprising signal strengths.

20–30 meters

As almost always, 20 meters will be your best DX band for both daytime and evening periods. Twenty will stay open until well after dark, and 30 meters really begins to shine in the late evening hours. Peak conditions exist shortly after sunrise at your location, and again in the late afternoon. Midday conditions are not likely to be good due to excessive ionization and absorption. Short skip will be excellent out to about 2500 miles on both bands on the best days.

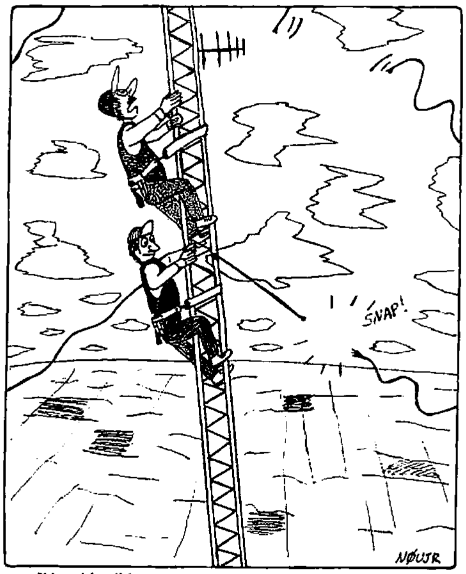
40–80 meters

Forty will be excellent after dark unless the noise levels from thunderstorm activity are excessive. These will be "all night" bands, with 40 slightly better than 30, except for noise. Daytime short skip will average 1000 miles or more and nighttime short skip will average 1500 miles or more—usually more.

80–160 meters

These two bands are not known for summertime DX, and May is close enough to summer to be a problem because of high noise (QRN) levels. However, on quiet evenings you may find superb DX across the Atlantic on 80 meters for US and European hams. One-sixty is always a summertime problem, but using Beverage antennas

Continued on page 88



"Harold...did you ever notice when you look up at the clouds...it looks like the tower is falling over?"

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA									15	15	15	
WEST COAST			80	80	40	40	40	20	20	20		

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

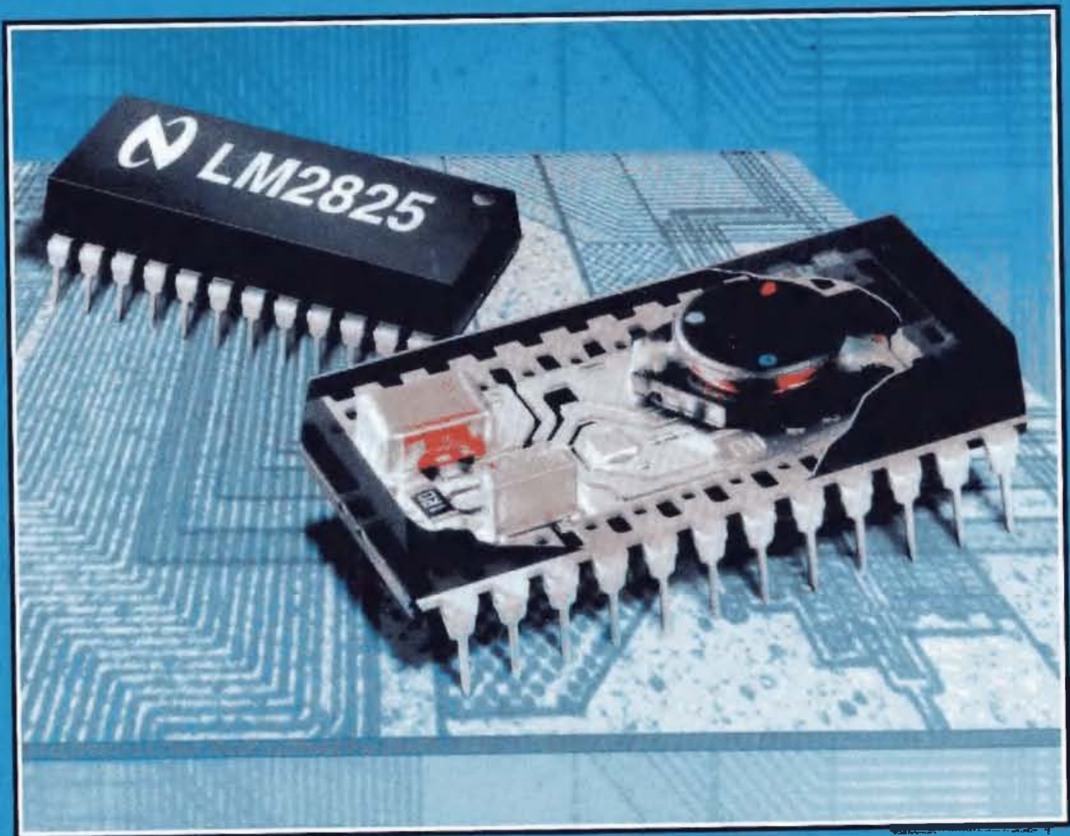
Including Ham Radio Fun!

JUNE 1998
ISSUE #453
USA $3.95
CANADA $4.95

International Edition

73® Amateur Radio Today

Cutting-Edge Technology Trims Power Supply Size



1 XSTR Fun Radio

How to Involve Kids

Ham Shopping the Web

Review:

Ham IQ Test

20m Micro-Vertical

A Real Simple Patch

JUNE 1998
ISSUE #453

73 Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

FEATURES

DEPARTMENTS

REVIEW

HAM RADIO FUN SECTION

On the cover: National Semiconductor chips will play a big part in your "Pentium-Style Positive and Negative PS." Article begins on page 10.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. *Canadian GST registration* #125393314. *Microfilm edition:* University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: *By being so nosey as to read this fine print, you have just entered into a binding agreement with 73 Amateur Radio Today.* You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

Never say die

Wayne Green W2NSD/1

Mea Culpa

Good heavens, here it is June already! Of course, magazine deadlines being what they are, I'm writing this in early April. We had an early spring here in New Hampshire, with two days in late March of 80° weather! Thanks, *El Niño*. But there are still some small patches of snow out there in the woods, and the crocuses are just now blooming.

After 60 years as a ham — sixty years in which I've done about everything there has been to do in the hobby — I have to admit that I need some new aspect of the hobby to get my juices flowing. I've ragchewed, DXed, DXpeditioned, pioneered VHF, NBFM, RTTY, SSTV, 10 GHz, aero mobile, computers, hi-fi, SSB, satellites, and so on. Am I burnt out, or is there a shortage of as yet unexplored ham territory?

My work with the New Hampshire Economic Development Commission got me interested in politics, education, health, and ecology, so I've been researching these fields — as you know from my editorials, if your memory hasn't been destroyed by a lack of trace minerals in your diet.

My pioneering instincts have led me into learning all I can about how we can be healthy, and into the paranormal, with things like dowsing, past lives, precognition of the future, those pesky ETs, and stuff like that.

It was this pioneering drive that got me so deeply involved with repeaters and 2m FM, which has given the world cellular telephones. Hey guys, we hams did that! We did it first and the hams at Motorola and G.E. pushed their companies to get involved.

Alas, not so much has come of our pioneering in RTTY, SSTV, and packet radio.

Anyway, as I find new areas of interest to learn about I'll do my best to stir what few embers of pioneering fire may be left in your breast — and blow some hot air on them to try and kindle new flames.

I hope I'm not boring you with my enthusiasm for health. There's so much baloney out there, both from our medical establishment and the alternative health field, that it's discouraging. Worse, I see almost all of you held prisoner of your habits — which are making you fat and sick, and are cutting 20-30 years or more off your lives. You should be like Norman Vaughn, climbing Mt. McKinley at 95, and not worried about breaking a hip if you slip. If you take care of your body it'll bounce when you're 95, not break.

I do appreciate hearing from you, and love it when you find a newspaper or magazine clipping about something I should know about. I'm not a big fan of E-mail — it's too slow to use and there's too much garbage to sort through. That 32¢ filter for snail-mail works best for me, so please use the US mule.

If you're into something new and exciting in amateur radio, I want to hear about it. I keep asking you to write about any ham adventures you've had, but nothing happens. As I keep telling you, my life has been full of adventure, and most of it happened because of amateur radio. If you haven't had adventures, that's your fault. They're there — if you dare!

Like I used to talk with Robbie 5Z4ERR in Nairobi a lot. He kept pushing me to come over for a visit. Then Jim K2ORS got me a wonderful cookbook by Herter. Fabulous! Herter had also written a book on how to go on a real inexpensive African hunting safari, so I wrote about it in my editorials, lined up some hams to go with me on the safari, and we had the time of our lives. I also got to operate from Robbie's station in Nairobi and work a ton of DX from there. Wow! That was worth two!!

We hunted and brought back all sorts of great trophies. We visited game parks to photograph the animals. We even got up into northern Kenya, Uganda and Tanzania. The adventure is out there waiting for you, so what's your problem?

When I started *73* in 1960 I moved it as quickly as I could from Brooklyn to New Hampshire and hired on a half dozen ham college dropouts for $20 a week, plus room and board. We were living in a 40-room 250-year old house, with me doing the cooking. We had a great time. We bought a house halfway up Mt. Monadnock and set up a bunch of towers and huge antenna arrays on all the UHF and VHF bands. Like 336 elements on 2m, with a kilowatt rig (which I built myself). We had a ball! We had a humongous signal, all the way down to North Carolina.

If you haven't managed to have any adventures, at least you could review the next piece of new ham equipment you buy (if you like it). When you have fun with some new gear, share your excitement and help reward the manufacturer with more sales. If you can think of any new ham horizons for me to get excited about, let me know. Otherwise I'll keep pushing cold fusion, making money, health, and fixing America's problems.

Those License Numbers

As our HF bands are gradually getting less clogged with QRM I'm hearing many amateurs saying that after all, why do we need more hams? Let's keep our bands as a private club for those of us who are left.

In looking at the FCC numbers I see that expirations, either physical (Silent Key) or mental (dropped out), are running around 5% per year for Advanced, General and Tech-Plus, near 10% for Novices, and about zero for Techs. Well, since the Tech license only started in 1991, we won't be seeing those dropout numbers reflected until 2003 (there's a two-year grace period).

The 5% expirations are half offset by new licensees, so our net loss is only around 2.5% per year. That's 25% in 10 years.

I see that the new Tech licenses have dropped in half this year as compared to 1997, so that well seems to be drying up, giving us a net loss of total hams this year. It's only a 0.5% loss so far, but there's no good reason to expect the drop not to escalate.

It's interesting that the same thing has happened in Japan! Their number of new amateur licenses was less than half that of just three years ago. Their total number of stations peaked in 1995. I expect we can thank the Internet for most of this loss of interest.

Do we have any reason to expect Tech licensees to renew their licenses? How many years does it take to get bored with talking to the same small group over the local repeater?

I doubt it will take 12 years, even for Chief Wiggam's kid. Look at how fast CB came and went! And it was a lot of fun while it was here. I had a great time with it — for a couple of years. I even took a CB rig with me when I flew to other cities and had a wonderful time talking with people.

Two meter repeaters were a blast in the 1970s, but then I found myself getting on the air mostly when I was visiting other cities, just as I had previously with CB. Now I seldom take an HT with me on trips. Burnout, I guess. So, circa 2003, if some major catastrophe hasn't wiped us all out by then, I expect we'll see monumental drops in the number of licensees. Unless, of course, the ARRL decides it's time to actually *do* something. Never happen.

Should we worry? Why? Does anyone much care?

Rumor

According to an ARRL letter there has been a rumor going around the bands that Cushcraft may be going out of business soon. Well, I know they cut their ads in *73* several years ago, and that *has* to have hurt their sales. Apparently they've had to cut back even further on their advertising and lay off workers. Back when Les Cushman W1BX was running the company Cushcraft had a reputation for making excellent antennas. Well, with the exception of the Ringo Ranger, which I found disappointing. But I did put up a 336-element 2m beam of theirs at my QTH up on Mt. Monadnock which gave me one whale of a signal for about 600 miles. But I haven't seen any signs of new developments from the company in years, so I'm not really surprised to hear about the rumor.

One other factor — they've largely been advertising in *QST*, but, as you know, the new hams (almost all Techs) are *not* joining the ARRL, which they see as the enemy. So, with the sunspots still weak, and their ads reaching an older, gradually disappearing audience, it's no wonder sales are way off. Thirty years ago I watched almost the entire ham industry die, advertising away loyally in *QST* until bankruptcy killed them. Is history about to repeat itself?

The Fun of Building

With parts so difficult to get these days, most of our newer hams are missing out on the thrill of building their own equipment. When I started out I was living in New York City, so I had a choice of a bunch of stores with endless tables full of parts. Tubes, sockets, pots, capacitors, switches — anything you could think of was available, and relatively cheap. So I bought parts. If I needed a variable capacitor I'd buy a dozen so I'd have what I needed the next time.

I built receivers, transmitters, amplifiers, test equipment and all kinds of gadgets. Then, after World War II, when stores filled up with war surplus stuff, so did my cellar, then my garage. Then three neighbors' garages. I spent many years at my work bench building stuff and modifying surplus.

When I moved from New York to New Hampshire in 1962 it took four van loads to get all my stuff up here. But by 1965 I saw that transistors were winning, so I had a huge auction and got rid of almost everything I had. I rented the local armory and filled dozens of tables with my stuff. I hated seeing boxes of hundreds of tubes going for $5, but I wanted good homes for my parts and equipment more than the money.

Every now and then I need something and sort of wish I'd kept maybe one ton of the old parts. Antenna relays haven't gone out of style yet.

One of the reasons I publish so many simple construction projects in *73* is my wish to share the fun of building with as many readers as I can. It's one of those indescribable thrills. English is a lousy language for expressing feelings, so all I can do is hope you'll give it a try and see what I'm trying to communicate.

These days it's impractical to try and find the parts for many projects, so we turn to our kit catalogs. To buy parts now you usually have to buy in bulk, and there aren't the bargains of my younger days. Back then we had thousands of American electronics firms building things. It was a lot cheaper for them to buy more parts than they needed for a production run than to run out, so there were always a bunch of parts left over which were sold off for peanuts, just to get rid of them. Old-timers will remember the dollar Poly Paks™ bags of parts.

Looking through the latest Ramsey catalog got my building juices going again. John has some great kits in there. They look like a lot of fun. His FM transmitters could have the FCC upset with you, though they've pretty much been ignoring most of the micro-broadcasters so far. But then you could build Ramsey's amplifier and start pushing things.

There's lots of great video stuff, motion detectors, light beam communicators, and so on. Call (800) 446-2295 and get the 32-page catalog and see if it doesn't get to you too. Then get out your soldering gun, clean the tip, and let's see what you can do.

One more thing: if I do suck you in on building, I'm going to be really upset if you don't drop me a note and let me know how much fun you've had. Hey, I need some feedback!

Yes, Ramsey has plenty of ham gear — eight pages of it. Heathkit may be dead and buried, but we still have some great kits available to us.

For that matter you ought to look into all those great MFJ kits too.

You have been letting me down by not reporting on the

Continued on page 39

LETTERS

From the Ham Shack

Thomas Miller WA8YKN. I read with interest Kenneth Stone's lengthy letter in the April issue of *73*. Mr. Stone wrote to me earlier claiming to have designed a circuit which he wanted to market under the name "Bioelectrifier." His complaint with my circuit seemed to be that I had negligently designed it to use a component not found in his "junk box." Since I've been using "Bioelectrifier" as a trademark since 1995, I told him that he would have to come up with a different name. "Bioenergizer" is close enough to be an obvious knock-off, but it is, at least, different.

The circuit Mr. Stone wanted to market used a 555 timer IC driving three transistors, one of which acted as an inverter, and the others as output drivers. I've received dozens of versions of this same basic design over the past few years. It's odd that many people seem to think that a 555 timer IC is *simpler* than a two-transistor multivibrator ... the 555 contains *two dozen* transistors. Simply drawing a box around them doesn't change the fact that it's increased the complexity of the circuit by a factor of twelve! Of course, you also need several external resistors and capacitors, and something to invert the output, all *in addition* to the 555 integrated circuit.

All of the 555 circuits I've seen (including Mr. Stone's) had a considerable imbalance in the positive-negative duty cycle. Far from the 5% imbalance mentioned by Mr. Stone, most of these ran in the 40/60 or 30/70 range. Shortly after my original article was published, I received a number of letters from people who, unlike either Mr. Stone or myself, actually *were* doctors (MDs and PhDs) and they expressed concern over using anything other than a balanced waveform due to metallic ion migration from the electrodes. The concerns were primarily over the use of aluminum, copper or nickel (stainless steel) as electrodes, and several recommended the use of silver as a safer alternative. Quite a few readers also sent me information from Dr. Robert O. Becker's book, *The Body Electric*, in which he cautions about hydrogen gas bubbles at even very tiny current levels. Since then, I've made sure that my Bioelectrifier devices had a symmetrical output waveform, and I use .999 fine silver for electrodes. Due to the very small current, there is probably no real danger, but it *is* a valid precaution, and as such I pass the information along to anyone who sends me a design with an inherent imbalance. I'm not "contradicting myself" as Mr. Stone asserts—I'm trying to share the data I've received over the past three years.

Actually, it *is* possible to achieve a symmetrical output with a 555 timer by adding an external discharge transistor, but oddly, none of the circuits I've seen use this trick.

As to Mr. Stone's comments that the multivibrator has imbalance as a characteristic, I took one of my devices at random and connected the output to my digital storage scope. Freezing the display and carefully positioning the cursors, the positive half of the

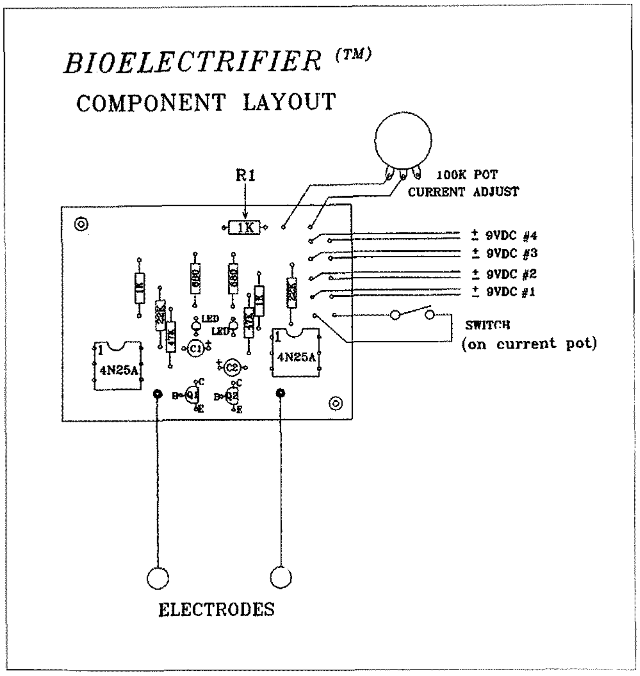


Fig. 2. Component layout.

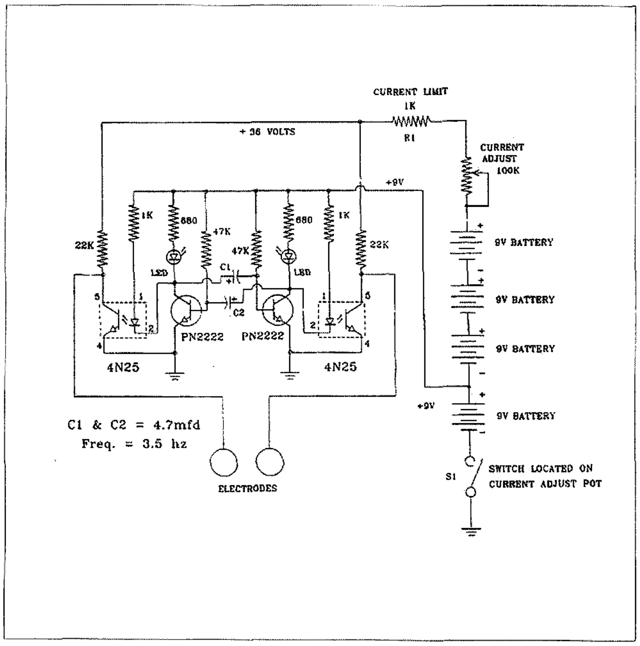


Fig. 1. Schematic.

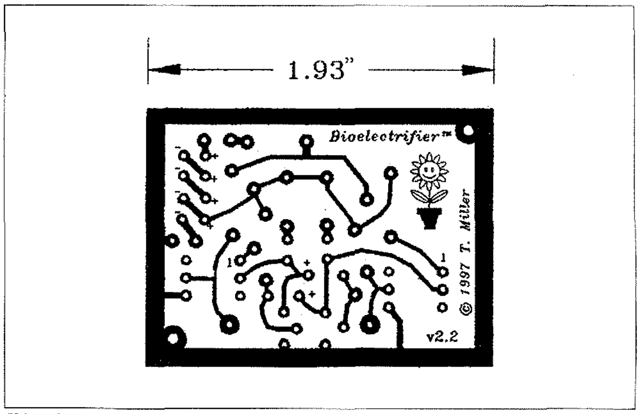


Fig. 3. Circuit board, actual size.

waveform measured exactly 148.0 milliseconds. The negative half also measured exactly 148.0 milliseconds. Hmmm ... not much imbalance there. By proper selection of values, symmetry is not hard to come by; today's precision laser-trimmed 1/8-watt resistors cost a whopping 1.4 cents each.

As Mr. Stone points out, silver won't kill you. In fact, the chemistry handbooks (Merck's, CRC, etc.) list skin discoloration as the only "toxic" symptom. However, this does *not* mean that silver has no other effect on the body, or that there is no long-term, low-level toxicity. (Remember that mercury amalgam fillings in your teeth are supposed to be OK, too!) For example, *Lectures on Homeopathic Materia Medica* by J.T. Kent lists *seven and a half pages* of symptoms related to low-level exposure to silver, including effects on the nerves and cartilage, increased tendency toward emotional outbursts, and mental excitability. Silver may be safer than copper, aluminum or nickel, but there is evidence that it can become a low-level irritant in the body. This is further reason to strive for a balanced output waveform, even when silver electrodes are used.

While the original circuit for the Bioelectrifier worked well and illustrated the process of designing a prototype circuit to fit a set of parameters, the output waveform had a small "spike" that tended to cause skin irritation if the current pot was advanced too far. To correct this, I chose values for the multivibrator components to slightly round the very top corner of the rising wave edge. I felt it was important to leave the vertical rise and fall alone, since it's possible that some of the device's effectiveness may be due to harmonic generation. This is easy to do with a transistor oscillator, but very difficult when using an integrated circuit, whether the 555 timer or Mr. Stone's latest circuit using the 4047. Simply putting a .1 µF capacitor across the output does not do the same thing—in fact, I could see no difference at all on the scope at 3.5 Hz. If the capacitor value was increased to the point where rounding occurred, it distorted the rest of the waveform as well. This is one reason for using the two-transistor multivibrator, as well as optocoupler output to prevent loading of the circuit.

It would be possible to eliminate the external LEDs charging the multivibrator capacitors through the LEDs in the optocouplers. This would cut the current drain in half, although you would have to select new R/C values to keep the wave shaping.

There's really little point in doing this, however, since the batteries last from four months to a year in normal use, and the LEDs provide a useful function, letting you know that the device is on and operating.

I've received many, many letters from "junior rocket scientists" with ideas for strange devices, and I always advise caution. One lady, for example, wondered if it would be all right to connect her electrodes through dropping resistors to an AC line cord ... after all, she assured me, the cord was UL®- and CSA-approved, and therefore should be safe! (I told her that the certification meant that, when she electrocuted herself, she wouldn't burn her house down.) If I think that there's a possibility of harm in something a reader wants to do, I'll do my best to get that information across. What they do with that information is, ultimately, up to them. If Mr. Stone wants to guarantee that something is safe, and in so doing take the responsibility for the actions of others, then of course he may do so. As for me, I'd rather be just a bit conservative (at least on paper!).

For those who would like to build the latest version of the Bioelectrifier, I'm including the current schematic and circuit board pattern. This information, and much more, is available on the Internet at [www.bioelectrifier.com] or my personal home page, [www.infocom.com/~thomil/].

You can also reach me via E-mail [thomil@infocom.com] or FAX (765) 962-3509, with comments or questions.

Steve Katz WB2WIK/6, author of "Techno-Trouble for Know-It-Alls" (April), and "Techno-Trouble II," in this issue, passes along some correspondence:

Jay Underdown WØPS to Steve Katz WB2WIK/6. Read your article in the April *73* and found a few glitches.

#4—For plane earth above 30 MHz increasing antenna height will increase signals by a known amount. Doubling the height will cause a 6 dB increase in signal level. I have enclosed a graph *(which we did not print—ed.)* from Bullington from his paper "Radio Propagation at Frequencies Above 30 mc/s," *Proceedings of the IRE*, Vol. 35, October 1947.

#5—Your explanation is in error if a "low noise" preamp is used. The effective sensitivity of a receiver is controlled by its noise temperature. The noise temperature is controlled primarily by the first active device in the receiver. A "low noise" preamp, by being the first active device, will increase the signal to noise ratio even if it *is* in the shack. This assumes that the noise temperature of the preamp is lower than that of the receiver itself. Borrow a SINAD distortion meter and test it for yourself.

#7—Your explanation is in error. When the voltage doubles, the current drops to 1/4.

$$\left(P = \frac{E^2}{R}\right)$$

I have some other problems with your article, but they are minor. Overall you did a good job of putting some radio myths to bed.

Steve Katz WB2WIK/6 replies to Jay Underwood WØPS. Thanks so much for your letter of April 8 re: "Techno-Trouble for Know-It-Alls," my recent article in *73 Magazine*.

I appreciate your input, but stick to my guns on all three issues:

#4—Your data is 51 years old and seriously flawed, I think, due to a variety of factors including (1) that real earth (reflecting plane) height varies considerably from location to location and there is no known constant; (2) we proved this data is not at all "independent of frequency" as alleged, in field studies performed while I was with AT&T Bell Telephone Laboratories, Holmdel, in our 1974-1975 empirical trials, which are well documented; (3) it expresses "plane earth loss between half-wave dipoles" and did not consider varying plane resistivities/reflectivities; (4) the chart does not consider vagarities in F-layer height and reflectivity; and (5) here at my own home station I have dipoles for 40 m installed at 35 and 70 feet (a 2:1 ratio), both east-west facing but located about 250 feet ($\approx 1.8\ \lambda$) apart at opposite ends of my lot and signals from distances >1000 mi average >>6 dB stronger on the higher dipole. During the 1996 November SS, for example, I spent a great deal of time taking average readings on about 100 signals from the eastern US, varying in distance from 2300 to 2900 miles, and the average enhancement from the higher dipole was 11.2 dB once S-meter readings were converted to reality by the use of my transfer standard, an HP 8640B. I'll admit, however, that on many "local" signals (0-500 miles), the lower dipole performed about as well, and frequently better, than the higher dipole. Based on Bullington's chart, this would never be the case.

#5—I fully understand what you are saying, and it is all true;

Continued on page 78

QRX . . .

KØOV Tapped as US ARDF Coordinator

73's "Homing In" columnist Joe Moell KØOV has been appointed the first Amateur Radio Direction Finding (ARDF) coordinator for the US. At its last meeting, the ARRL board of directors authorized creation of this volunteer position to promote international-style foxhunting activities, especially as a means to involve more youth in the hobby. The appointment was made by the League's executive secretary, Dave Sumner K1ZZ.

ARDF coordinators have been appointed by the national societies of over 30 International Amateur Radio Union (IARU) countries. In this hemisphere, Canada is the only other country with an appointed ARDF coordinator at this time. Canada's ARDF coordinator is Perry Creighton VE7WWP.

ARDF coordinators have formed multi-nation ARDF Working Group committees in Europe and Asia that host international ARDF championship competitions. The next such event will be the ARDF World Championships in Hungary this fall. One goal of foxhunting enthusiasts in the US and Canada is to hold an IARU Region 2 championship foxhunt in 1999. For the latest ARDF information, read "Homing In" each month in *73 Amateur Radio Today* magazine and visit the "Homing In" Web site [http://members.aol.com/homingin/].

Anti-Mobile Law Stopped In Its Tracks

Some good news for hams living in Wisconsin—the threat of a new state law that would ban the mobile in motion use of two-way radio equipment has ended—at least for now.

Smoke Signals newsletter editor Jim Romelfanger K9ZZ states that Wisconsin Assembly Bill 754 is basically a dead issue. Romelfanger says that he spoke with one of its sponsors and learned that it has not even had a hearing, let alone been reported out of committee. Jim says that with only a few days left to this year's Wisconsin Assembly session, that there is no way for AB 754 to become Wisconsin state law.

AB 754 was primarily aimed at curbing automobile accidents caused by inattentive cellular telephone users. Unfortunately for hams, the wording of the measure encompassed all forms of mobile radio communications. Its backers are expected to try to pass it again in the next Assembly session. In the meantime, hams have a chance to build a solid opposition to it, or at least demand an exemption for licensed radio amateurs.

Two Hams Assigned to John Glenn Flight

Two hams—US astronaut Scott Parazynski KC5RSY, and European Space Agency astronaut Pedro Duque KC5RGG, of Spain—will be among an international crew this fall when US Senator John Glenn gets his second chance at space travel. The STS-95 mission will mark the third shuttle flight for Parazynski, a medical doctor who trained for a stay aboard *Mir* but had to be reassigned after it was determined he was too tall to fit the Russian space suits worn aboard the *Soyuz*.

It's still not known at this time if the Shuttle Amateur Radio EXperiment (SAREX) payload will be aboard STS-95, which is scheduled to go up in October. The launch date for the only scheduled SAREX mission, STS-93, has slipped from August to December. The STS-95 flight that will carry the United States' newest and oldest astronaut into space has been under consideration for several months as a possible SAREX flight. Nothing has been confirmed yet, however. Crew members now are looking at possible secondary payloads for the mission. Glenn, who will be 77 when he goes into space again, has begun his astronaut training. He has undergone extensive medical tests. This week, he spent time in a centrifuge for the first time in decades.

Other members of the STS-95 crew include Japanese astronaut and cardiologist Chiaki Mukai, and Americans Steve Lindsey and Steve Robinson. Commanding STS-95 will be shuttle veteran Curt Brown.

From the *ARRL Letter*, via *Tuned Circuit*, March 1998.

Ham Radio History

4,000,000,000 BC: Earth is a swirling ball of flames. Propagation is extremely poor.

1,000,000,000 BC: First dry land appears. It is divided up into grid squares.

500,000,000 BC: Second patch of dry land appears. First DXpedition; DXCC credit disallowed because of questionable licensing agreement.

400,000,000 BC: Flowering plants and grasses evolve. Rotary beam invented, but sales stall for lack of suitable mounting structures.

300,000,000 BC: First tree appears and is immediately cut down, stripped of branches, placed in a concrete base and called a telephone pole. Beam sales pick up.

200,000,000 BC: More beams sold. Installer falls from top of pole. Safety belt is invented.

100,000,000 BC: First mountain appears. The repeater is invented.

50,000,000 BC: CQ is adopted.

4,000,000 BC: Humans replace swine as dominant species. The name ham operator hangs on, however.

3,000,000 BC: Dugout canoe invented. Maritime Mobile Net formed on 14.313 MHz.

2,000,000 BC – 800 AD: Nothing much happens for a long time.

900 AD: Chinese invent gunpowder. BY1AA is first "Big Gun" DXer.

1790 AD: Ben Franklin invents longwire receiving antenna.

1961 AD: Second repeater erected. First repeater group refuses to change frequency. First repeater coordinator appointed.

1998 AD: Amateur radio humor sinks to a new low.

From *ARRL Letter,* Vol. 16, #49, via January's *RF-Carrier*, newsletter of The Dayton Amateur Radio Association, Mike Priest KB8JUA, editor.

100-Year-Old Hobby Takes on New Life

For the past century, the hobby of amateur radio has challenged the technically inclined with its promise of instantaneous global communications. The world's radio amateurs, known as hams, have contributed to virtually every breakthrough enjoyed by the telecommunications industry, including the development of the Internet. Ironically, the widespread availability of low-cost digital communications (including cellular telephone, E-mail, and the Web) has is recent years slowed the growth in ham radio's ranks. Now the amateur radio community is revitalizing itself by applying its members' talents in search of other life forms.

"As our society becomes technologically mature, the role of ham radio has to change," observes Dr. H. Paul Shuch, a lifelong radio ham and the Executive Director of the nonprofit SETI (Search for Extra-Terrestrial Intelligence) League. "Searching for life in space requires the kind of radio skills which hams possess, and cannot be conducted by simply logging on-line. It involves the design and construction of antennas, receivers, and signal analysis hardware and software—which is what ham radio is all about." With over 700 members in 40 countries on six continents, and a plan in place to grow to 5000 stations in its global radio astronomy network, The SETI League is "the ultimate ham club," according to

Continued on page 79

A Pentium-Style Positive and Negative PS

Reading about new technology is great, but using it is even better!

Sam Uibing N4UAU
5200 NW 43rd Street
Suite 102-177
Gainesville FL 32606
[n4uau@afn.org]

Suppose you saw this ad in the paper: "For sale: IBM PC with DOS 2.0 and 640K memory."

Would you get excited? Probably not, because if you are like most hams, you already have a Pentium™ computer with 32 megs of memory, a gazillion-byte hard drive, and, of course, Windows 95™. Do you really need all that awesome computing power? I know *I* don't, but hey, it's the way of the future and I don't want to become obsolete! Pentiums, laptops, cell phones and GPS all exist because of rapidly advancing electronic technology that provides better chips every day.

So tell me, why would anyone get excited about a ham project that uses 1970s technology? Yawn. "Bor-ing, obsolete." Yet many ham projects do use these "outmoded" parts. Why? I think there are a number of reasons. Technological changes happen so fast that it's a full-time job keeping up with them, and ham radio is a hobby, not a job. The best new parts are not readily available to the amateur user, or they are expensive to buy in small quantities. Does this mean that ham radio is going to go the way of the dodo and become extinct?

I, for one, hope not—and I try to fight obsolescence in my ham shack by building projects that use some of the new technology. I spend a lot of time reading technical literature, locating new ICs, and figuring out ways to apply them to ham radio. Some ICs require a bit of technical skill to use, and I am having fun learning. Others do not require much knowledge at all, since the technology is already built into the IC. As my knowledge and skill working with these new products increases, I hope to be able to build more sophisticated projects.

If you, too, are interested in learning more, the simple devices in this article are ideal as starter projects that use the latest in technology, as well as offer a good opportunity to gain skills and knowledge. I find that I learn best by actually building and using instead of just reading, and here's how I added some "Pentium-style" technology to my shack.

Need and solution

I needed a power supply that could source up to one amp positive current at +5 V and 150 milliamps at -5 V. The currents are different because part of my project needed only positive voltage. My solution is a power supply that uses a switching DC-DC converter and a surface-mount switched capacitor voltage inverter. I did not choose this solution because of the technology—I chose it because without the new technology I could not have made the device at all.

A positive five-volt power supply

There are many ways to make a five-volt power supply. If you have AC, you can use a transformer to get an AC voltage near your desired DC voltage, and then use a diode and capacitor to rectify it. Finally, you would use a voltage regulator to prevent the voltage from varying with the load. One such power supply is presented in the January 1997 issue of *73* ("A Positive and Negative Power Supply," J. Frank

Brumbaugh). Such power supplies have been in use for a long time. They are generally efficient and not too costly, as long as you can find a transformer with the right output voltage. On the negative side, they can be bulky and they require an AC input which is not conducive to portability.

I run most of my shack from a 12-volt battery for several reasons: most of my projects are low-voltage DC projects; if the power goes off I can still operate; and I am able to take any of the projects with me on my boat and know they will still work. So when I needed five volts, I wanted to get it from my 12-volt battery rather than use an AC source. I have made many five-volt power supplies from 12-volt sources before, using linear regulators from the 1970s like the LM7805. They are small, cheap, and readily available, and some versions can supply up to one amp. But when I hooked up my circuit and turned on my load, the regulator got hot very quickly.

This is a limitation with a linear regulator because it is nothing more than a resistor. Granted, it is a *fancy* resistor because it changes its value as the load changes to maintain a constant output voltage, but like any resistor it is subject to Ohm's law:

Power = Current x Voltage.

When I connected mine to the 12-volt battery and put on the half-amp load, the drop across the "resistor" was 12 – 5 = 7 volts and the power (heat) dissipated in the regulator was 7 x 0.5 = 3.5 watts. That's a lot of heat and might offer the basis for a nice 12-volt-powered hot dog cooker, but I didn't think it would do as an electronic circuit without a large heat sink. I wanted a better solution.

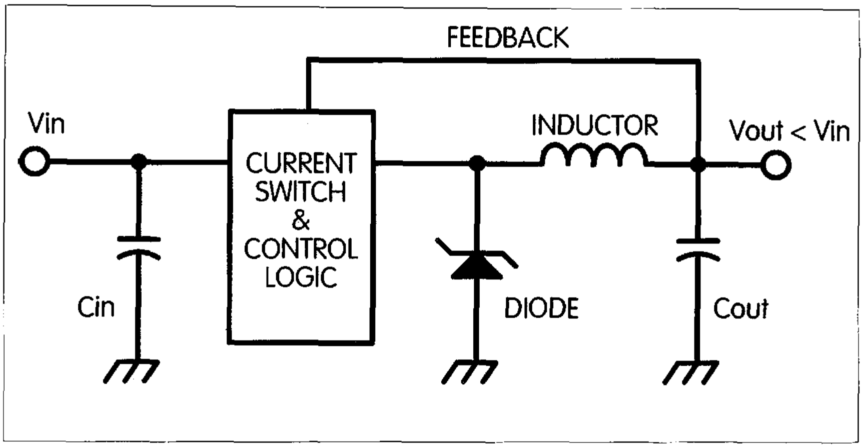


Fig. 1. Basic "buck" regulator.

The November 1996 issue of *73* had an article, "Switching Power Supplies," by Dave Miller, which discussed the basics of switching regulators. As he noted, these new devices have several advantages: They are efficient, can handle more power, and can decrease or increase DC voltage. Dave discussed how these devices work by using an inductor to cause a voltage change. A change in current through an inductor will cause it to generate a voltage opposing the current change. By switching the current through the inductor on and off very rapidly (changing it rapidly), it is possible to get a higher or lower output voltage. A diode and capacitor are then used to rectify the new voltage.

The principle is simple, but as a 1987 Linear Technologies Applications Note commented, "Unfortunately, switching regulators are also one of the most difficult linear circuits to design. Mysterious modes; sudden, seemingly inexplicable failures; peculiar regulation characteristics; and just plain explosions are common occurrences." Obviously, this was not something an amateur would want to try!

By 1996, I found that the technology had advanced when I read a National Semiconductor ad about their Simple Switchers™, which they claimed made building regulators easier for *novices*. With some effort I finally was able to locate all the parts to build a neat DC voltage booster. Since then, National has continued to improve this line of regulators.

Recently they introduced the LM2825, a switching regulator that is likely to become the 78xx of the next century (**Photo A**). This regulator is so easy to use, you would think it is "only" another linear regulator—in fact, it is a sophisticated buck-mode switcher (a "buck" regulator reduces voltage and a "boost" regulator increases it). As of the end of 1997, the LM2825 family had five different voltage versions (3.3, 5.0, 12.0, and two adjustable versions). The adjustable versions work like the LM317-type regulators.

The circuit and operation

Fig. 1 shows the circuit for a buck-type regulator, and **Photo B** shows my five-volt regulator using the LM2825. "Hey," you say, "there's just one IC. Where are the inductor, diode, and capacitor?" Well, they're actually built right onto the chip.

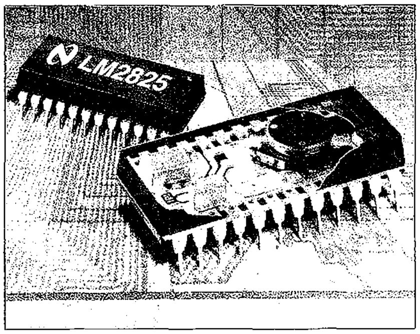


***Photo A.** The LM2825 switching regulator. Photo courtesy of National Semiconductor.*

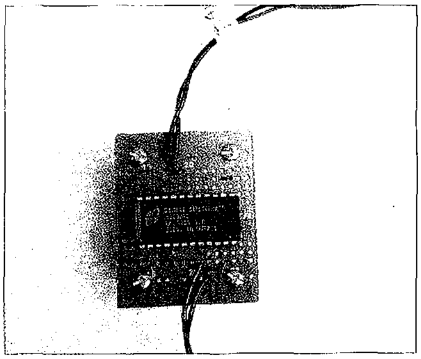


***Photo B.** A "Pentium-style" buck regulator. Photo by author.*

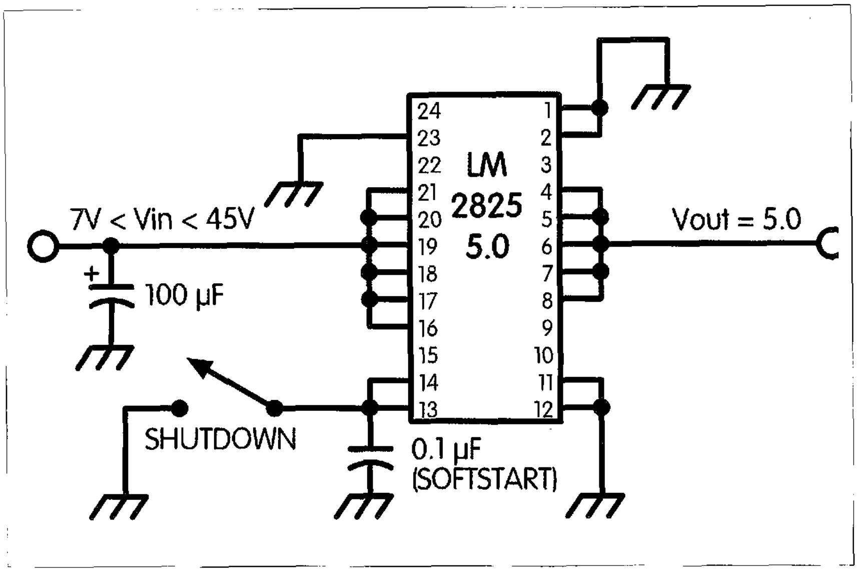


***Fig. 2.** LM2825-5.0 buck-type regulator with optional capacitors.*

I soldered the chip to a PC board, and added two optional capacitors, and hooked up my load. Twelve volts in, five volts out, and the chip doesn't even get warm. My 7805-based power supply is now collecting dust.

National claims awesome reliability: 20,000,000 hours mean time between failure (which they note is 2,283 years). Remember when parts used to fail every few years? The regulator is environmentally friendly since it is 80% efficient and thus conserves energy. Compare this to the LM7805, which is only 42% efficient with a 12-volt input (unless you use the other 58% to cook those hot dogs!). Both are internally protected for power dissipation, but obviously the switcher will be able to convert a lot more power before it overheats. If you use the regulator in a portable circuit, particularly one that has a computer control, you might appreciate the fact that the regulator has a shutdown mode that draws only 65 µA.

Fig. 2 shows my regulator with the two optional capacitors. C_{in} is only required if the main bypass capacitor is more than six inches away from the IC. A low-ESR (effective series resistance) aluminum capacitor is recommended to prevent switching transients from appearing at the input. The current rating of the capacitor should be at least half the DC load current, and the voltage rating 1.25 times the maximum input voltage. The Panasonic series HFQ or Nichicon PL series are suggested, but I used a 100-µF HFS series I had and it worked well. While it is possible to use tantalum capacitors, they are not recommended with a low-impedance power source (like a car battery) due to the high inrush current which can cause shorts in tantalum capacitors. Also, ceramic capacitors can cause ringing at the V_{in} pin.

C_{ss} is an optional soft-start capacitor. When a switching regulator first starts, there is a large current surge. If your power supply has a fairly high output impedance, you could have start-up problems due to voltage drops. C_{ss} reduces the start-up current demand by ramping up the current with a series of pulses of increasing width. This ramp-up also reduces the start-up surge current on the load. For input voltages above 12 volts and higher temperatures, this capacitor may be required for proper operation, so I thought it was a good idea to put one in anyway. A 0.1- to 1-µF tantalum or ceramic capacitor is recommended for this purpose.

Because they operate by pulsing the current (this chip runs at 150 kHz), switching regulators tend to be noisier than linear regulators. I have not noticed a noise problem when using mine but if you do, it can be reduced by adding a low-pass filter as shown in **Fig. 3**.

Although you might not guess it from this project, switching regulators are still complex systems to design. If you want to build a boost-mode switcher with discrete parts, check out "My All Purpose Voltage Booster," *QST*, July 1997.

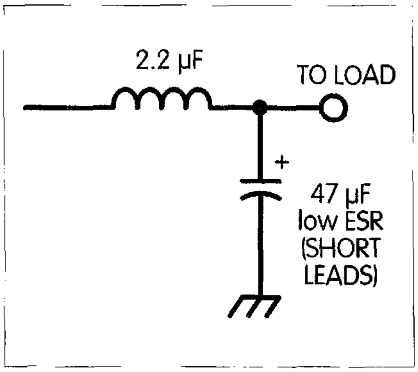


***Fig. 3.** Optional noise filter.*

A negative five-volt regulator

Now that I had my five-volt source, I thought I was all set. To supply the -5 V from the +5 V I could use a 1970s switched-capacitor voltage converter like the ICL7660. I had used these for several earlier projects, but when I checked the data sheet I found that this chip has a high output impedance (60 ohms or more). With no load, I could get -5 V but with a 20-milliamp load the output would only be -4 V—and I needed eight times that current. Foiled again.

Once again, I started looking for new and improved products. Maxim had a couple of improved versions of the 7660, but these didn't provide enough current. Then, last spring, National Semiconductor announced their LM2662, a switched-capacitor converter with 3.5 ohms of output resistance. With my 150 mA load I would get about -4.5 V, which would work.

As I was looking for an inverter, I noted that many of the newer and better ones were only available in surface-mount packages. Such was the case with the LM2662, which comes only in a surface-mount SO-8 package. Fortunately, I developed some SMT skills with a previous project ("SMALL, a Surface Mount Amplifier that is Little and Loud," *QST*, June 1996). I welcomed the chance to improve my skills, because I know that the inside

of my Pentium computer is almost entirely SMT. It doesn't take a rocket scientist to know that in the future more and more ICs will be available as SMT *only. (Readers new to SMT may want to peruse Dave Miller NZ9E's "Surface Mount Devices,"* 73, *October 1997.—ed.)*

Photos C and **D** show my +5 V to -5 V inverter next to a dime. I put the capacitors on the back side of a double-sided piece of copperclad to keep the size smaller, and because it made the board easier to fabricate. Note that just as with older technology, the capacitors are bigger than the IC. But the two 100 µF 16 V SMT capacitors together are still smaller than a dime. The whole project could be built on an even smaller piece of circuit board if I ever get skilled enough. (It's like CW; I keep working at it and slowly I get better.)

The circuit and operation

Fig. 4 shows the circuit for my inverter, and **Fig. 5** shows how it works. This is a very simple circuit: just two capacitors and one IC. In fact, it is the same circuit used with the ICL7660, and its operation is the same. The IC consists of four large CMOS switches, S1–S4, that are switched in sequence by an internal oscillator. During the first time interval, S1 and S3 are closed and S2 and S4 are open, and the +5 V input charges CI with the pin 2 side being positive and pin 4 at ground. At time interval two, S1 and S3 are open and S2 and S4 are closed. There is still 5 V across CI, with the pin 2 side being positive, but pin 4 is no longer at ground potential. The 5-V charge across C1 is transferred to C2, and since C2's positive side is connected to ground, the other side must be 5 volts lower than ground, or -5 volts.

The reason this switch can handle more current and still be smaller is because technology has created better switching circuits. The LM2662 has about two ohms of effective internal resistance, while the ICL7660 has about 50 ohms. The output resistance is also affected by the ESR of the external capacitors, so it is important to use low-ESR ones. The ESR of CI is

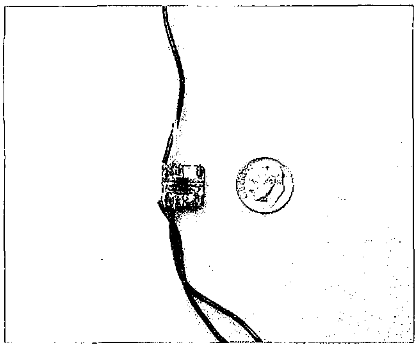


Photo C. Author's LM2662 SMT unit is smaller than a dime. Photo by author.

four times as important as that of C2. Larger capacitance values for C1 will also reduce the output resistance, while larger values of C2 reduce the output ripple. I did a series of tests and discovered that the input source resistance is also important, although the data sheet makes no mention of this fact. When I put a one-ohm resistor in the input line to measure input current, the output resistance increased. A standard 100-µF (or larger) electrolytic capacitor at pin 8 noticeably reduced the resistance.

The LM2662 has features that let the user optimize the circuit for his particular application. Pin 1 controls the frequency of the internal oscillator. The normal frequency is 20 kHz, which minimizes the chip's quiescent current. If size is important, pin 1 can be set high, increasing the frequency to 150 kHz and allowing the use of smaller capacitors at a slight decrease in efficiency. When conversion efficiency is most important (such as for a portable laptop design), an external oscillator can be used. The data sheet shows that different loads have different ideal frequencies. For instance, a 2-mA load is most efficient at 1 kHz, a 20-mA load at 10 kHz, and a 160-mA load at 40 kHz.

The LM2662 can also be used as a voltage doubler with a 2.5- to 5.5-volt input or as a voltage "halver" for inputs from 1.5 to 11 volts. These circuits are discussed in the National Semiconductor data sheet for this product.

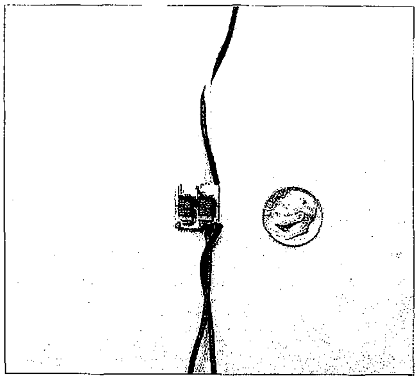


Photo D. Reverse side of LM2662 inverter card shows two low-ESR 100-µF SMT caps. Photo by author.

Building the inverter

The challenge to the amateur builder is how to build something this small. The way I have found best for me is far from perfect, but I have built quite a few projects this way and it works if you are careful. I think it is easier to make an SMT board than a DIP board, because there are no holes to drill and no messy chemicals if you use my approach! I would appreciate any input from readers who have also done SMT.

I started by sketching a layout for my PC board. I did not worry about drawing it to scale but made it large enough to see what was happening. Normally, I'm used to thinking in terms of connections between parts, because for schematics we draw lines from point to point to represent the wires. I found in laying out my PC board that it was more useful to think in terms of the spaces between the lines. This is because I was starting with a copperclad board, and really did not care how wide the traces were. All I wanted was to ensure that they did not touch. I would be cutting out copper material to separate the traces, not adding material to make traces.

Fig. 6 shows my final layout. I chose to use double-sided board, both because it would make the project smaller and because it was easier to fabricate the circuit this way. A consideration in the layout was that the spots where wires were attached needed to be relatively quite wide. To connect the capacitors to the pins on the IC, I could have drilled small holes through the board, but I felt it was easier to run the traces such that I could wrap small jumper wires around the edge of the board (see **Fig. 6**, a, b, c, and d).

The side with the IC was the more difficult side to make, since the IC had eight pins, each spaced 0.05-inch apart—so the cuts needed to be narrow as well as precisely located. I tried a number of methods, but found that the

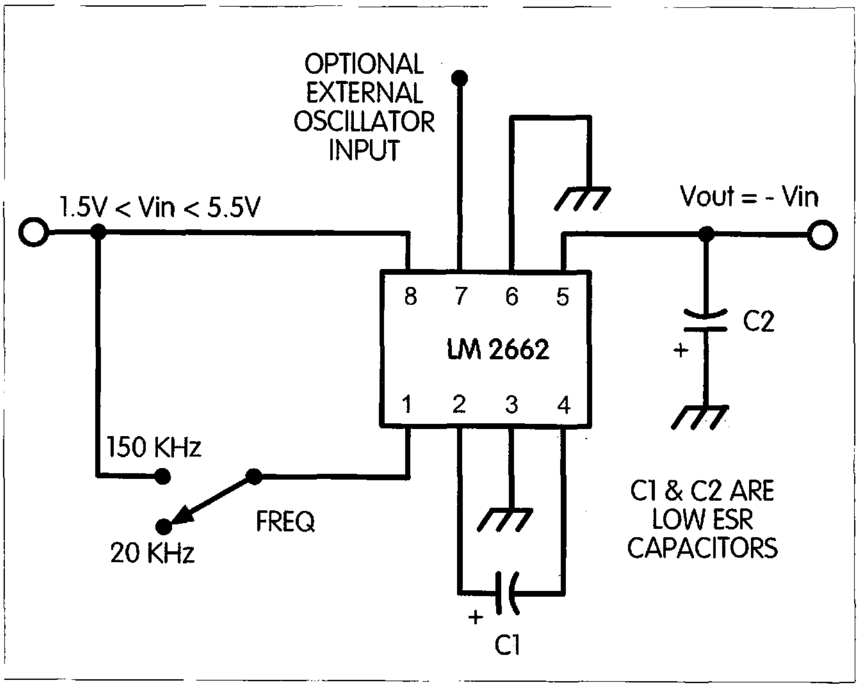


Fig. 4. Switched capacitor inverter using the LM2662.

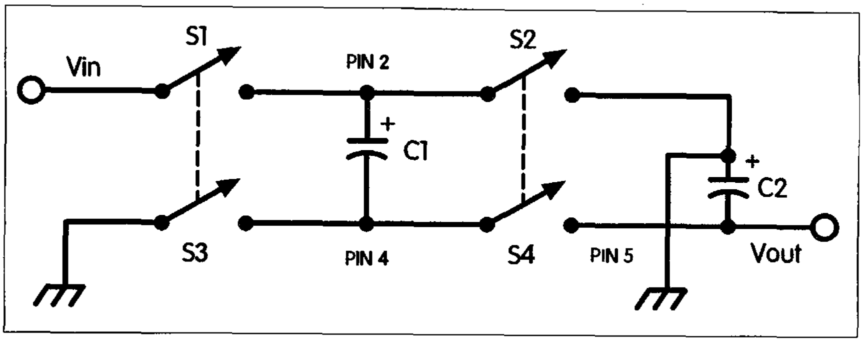


Fig. 5. Internal switch configuration.

brute force way worked best for me (I do not have a shop full of precision machines). I taped the chip to the copper and used a fine sharp-pointed tool to scratch the location of the cuts on the PC board. I did this freehand. I then removed the chip and used my Dremel™ tool to cut the material where the traces were. I also did this freehand. It was much easier than I thought it would be to keep a reasonably straight line.

With an earlier project I used a fine cutting bit (#108). It had a sharp edge

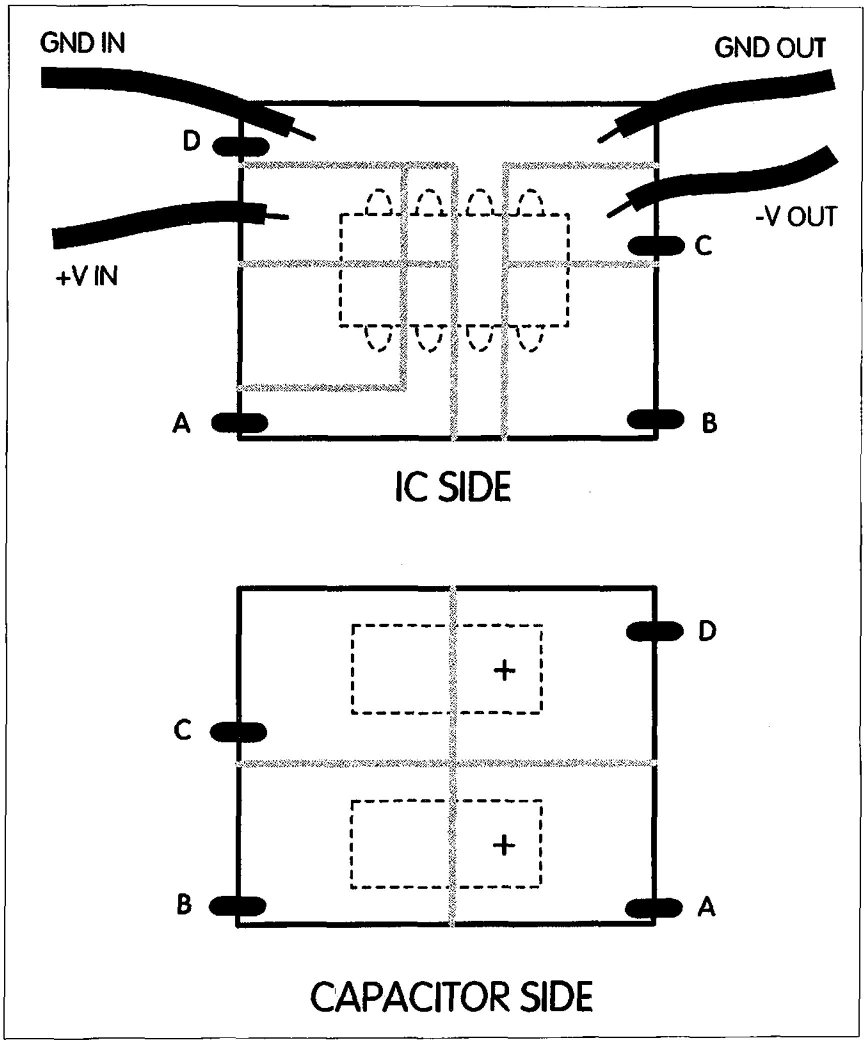


Fig. 6. Layout used for LM2662. Gray lines indicate areas with copper foil removed. A–D are wire jumpers to opposite side of board.

that cut quickly and made a narrow cut if not pushed too far into the material. By holding the Dremel at an angle, I was able to steady my hand and also get the best angle for the cutting bit. Perhaps I have refined my technique, because this time I used a very fine cutoff wheel with the Dremel. I found that an ultrathin (7/8-inch by .009-inch) wheel made a very narrow cut, as well as made it easier to cut a straight line than when using the other bit. Be very careful not to cut too deeply into the material. When making intersecting cuts such as the center line, cut on the IC side. I stopped well before the crosstrace and then used the #108 to finish off the cut. A quick sanding deburred the cuts. I then traced through the cuts with a small screwdriver to be sure they were all cleanly cut. Finally, I used my ohmmeter to verify that the traces were separate.

Attaching the parts

Handling such small parts can be a challenge, although for this project the capacitors are huge (compared with ceramic ones). Tweezers work well to hold the chip. You will need to push and prod the part to line it up on the board, and once you get it lined up, you need to hold it in place so the soldering iron doesn't move it. I generally use a small screwdriver or my fingernail to hold the part to the board while I get one of the pins soldered down. After you get the first pin soldered, you can make small adjustments in position and solder the other pins. Your soldering technique will have to change for these small parts. Normal small iron tips are too large. I found an ideal tip for my Weller WCC100 iron, # ETJ, which is a 1/32-inch chisel tip. While "old-fashioned" .030-inch solder works fine for "old-fashioned" projects, it is too big for SMT and will tend to cause bridges. It's better to use .020-inch-diameter solder.

Soldering the tantalum capacitors was easier than soldering the chip. Just remember to keep the polarity correct—particularly for C2, which has its positive side to ground. I just put them on the board, held them in place with my thumbnail, and soldered.

You will find it very difficult to remove an incorrectly soldered part because the solder joint is both a mechanical and electrical connection. Even using solder wick, enough solder remains between the board and the part that the part will stay stuck to the board. If you use a knife to pry up the heated end, you are apt to tear the other pins. Clearly, the best procedure is to do it right the first time!

Locating the parts

Because these parts are so new, they are not yet widely available. Gerber Electronics stocks both the LM2825 and the LM2662. Newark Electronics stocks the LM2825 and low ESR SMT capacitors such as the Sprague 595D series, but not the LM2662. Both places will sell in small quantities. Digi-Key, which normally stocks National Semiconductor products, does not yet stock either part but informed me they might stock them when demand increases. Several wholesale distributors carry these products but do not sell in small quantities. By the time this article goes to print, both chips might well be more readily available. If you find that SMT capacitors are hard to find, non-SMT capacitors will work also—look for low-ESR capacitors for best results.

Author's note: If you want to learn more about building switchers from scratch, I suggest Linear Technologies' Application Notes AN19 and AN25; you can find copies of these at their Web site [http://www.linear-tech.com]. Since new products are always being introduced, you might also wish to visit the National Semiconductor Web page [http://www.national.com], which has data sheets and application notes for all their products. Other Web sites worth checking are: Gerber Electronics, [http://www.gerberelec.com]; and Newark Electronics, [http://www.newark.com].

The Fun Radio

... or, wasn't this what attracted you to the hobby in the first place?

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

With modern electronic components to help you, step into the past and enjoy the technology of yesteryear. Most people feel that current technology is better than that of the past—and rightly so—but one can enjoy the older technology and maybe even learn something interesting in the process. The Fun Radio combines both old and new technology in one simple project, and many circuit options are available for the experimenter. You can switch options around, according to your needs and component availability.

Fig. 1 is a diagram of an Armstrong Regenerative Detector/Receiver, capable of tuning from below 100 kHz up to about 18 MHz. (**Table 1** shows many of the services within this range of frequencies.) There were a great many oscillator circuit designs developed between 1910 and 1930, each more popular than the last. Many of those designs are still used today, but the oscillator developed by Armstrong has consistently been the most popular for use as a regenerative receiver.

In operation, the circuit performs in a "reflex" mode, where it functions simultaneously at both RF and audio frequencies. In the RF mode, the circuit is allowed to oscillate by providing feedback from the collector to base of Q1 through the tickler coil. Feedback is shifted 180° and is fed back through the tuning winding. Full oscillation occurs when the collector of Q1 is driven from saturation to cutoff. However, when the circuit used as a detector, the amount of feedback is reduced/controlled by the user to achieve the desired detection results.

In detection mode, an incoming signal is mixed with the RF feedback, and if the feedback amount is critically adjusted, the collector current of Q1 will

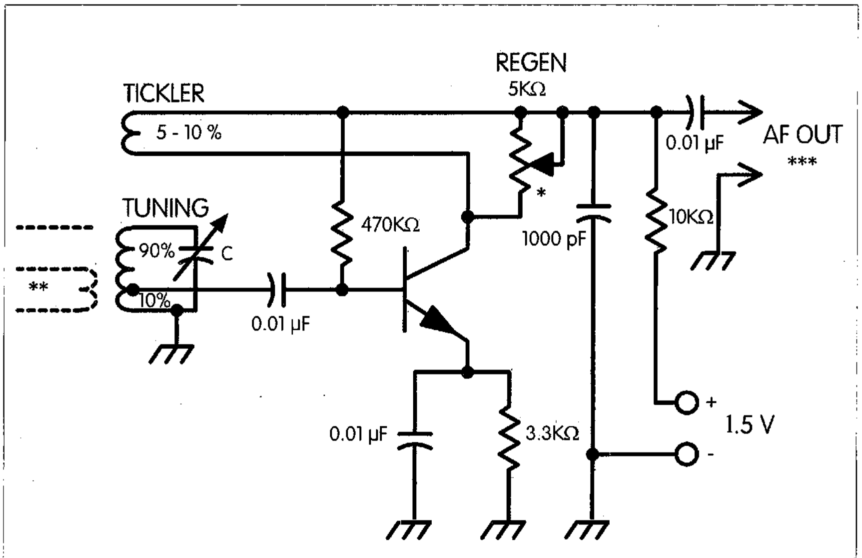


*Fig. 1. The Fun Radio. Q1 can be most any NPN transistor, such as 2N2222, 2N4401, 2N3904, 2N918, Key to symbols: % = Percent of total number of turns selected for the tuning coil. * = See **Fig. 3** for regeneration control options. ** = See **Fig. 2** for antenna options. *** = See **Figs. 4** and **5** for audio amplifier options.*

follow the amplitude variations of the received signal's modulation envelope, which is audio. The detected audio is then coupled to the audio amplifier.

Fig. 2 shows three antenna input options. **Fig. 2a** is suitable for antenna lengths under 30 feet where direct coupling to the tuning circuit is achieved through a trimmer capacitor which can be adjusted for maximum signal coupling and for minimum loading on the circuit. For an antenna wire longer than 30 feet, a coupling coil may be used as shown in **Fig. 2b**. The coil is wrapped around the ground end of the tuning coil where the number of turns required must be determined experimentally, but typically five to 15 turns is normal. Should the coupling be too tight and excessive loading occurs, the addition of a series trimmer capacitor, as shown in **Fig. 2c,** will reduce and provide control of the loading. Most any trimmer capacitor value, such as 3–30 pF, 7–45 pF, or 10–100 pF will work well in this application. Antenna loading on the tuning coil must be kept as light as possible in order to allow the circuit to regenerate properly.

	100 kHz
Low Power Beacons	200 kHz
Weather	
	400 kHz
	500 kHz
AM BC Band	
	1 MHz
160 m (1.8–2.0)	2 MHz
80–75 m (3.5–4.0)	3 MHz
	4 MHz
WWV (5.0)	5 MHz
	6 MHz
40 m (7.0–7.3)	7 MHz
	8 MHz
Foreign BC	
	9 MHz
WWV (10.0) 30 m (10.10–10.15)	10 MHz
	11 MHz
Foreign BC	
	12 MHz
	13 MHz
20 m (14.00–14.35)	14 MHz
	15 MHz
	16 MHz
	17 MHz
17 m (18.068–18.168)	18 MHz
	19 MHz
	20 MHz
15 m (21.00–21.45)	21 MHz

***Table 1.** Frequency spectrum from 100 kHz to 21 MHz showing ham bands and other services.*

Sensitivity over the operating range will rival that of a modern superheterodyne receiver. In fact, the sensitivity is controllable. An interesting thing about the Fun Radio is that it will demodulate CW, AM and SSB. It would perhaps demodulate FM, as well, if FM were used on the bands covered by the radio. On the down side, the receiver's bandwidth is quite wide, which can be troublesome when listening in the ham bands. However, the bandwidth is not as critical when listening to CW.

Operation

For proper operation and tuning a station it is necessary to fuss with the tuning, antenna loading, and regeneration controls. Much of the fun comes from mastering the use and operation of the radio. By controlling the amount of feedback, the sensitivity and modulation mode may be accommodated. CW and SSB can be copied by advancing the regeneration control (increasing feedback) until a squeal is heard. At that point the circuit is in full oscillation and a heterodyne will be heard between the oscillator and the incoming signal. Receiver sensitivity will be the greatest at this point as well. Slight adjustments of the tuning, antenna loading and regeneration controls will provide clarification of the received signal. To demodulate AM, decrease the regeneration to just below the point of oscillation, or until the audio is clear of a squeal.

Builder's choice

Circuit regeneration techniques are open for experimenter choices as shown in **Fig. 3**. **Fig. 3a** uses a shunting potentiometer across the tickler winding, which is the most commonly used method. The pot wiper and pot shaft should be connected to the decoupling capacitor side of the tickler coil, or some hand capacity effects may be noted during operation. Typically,

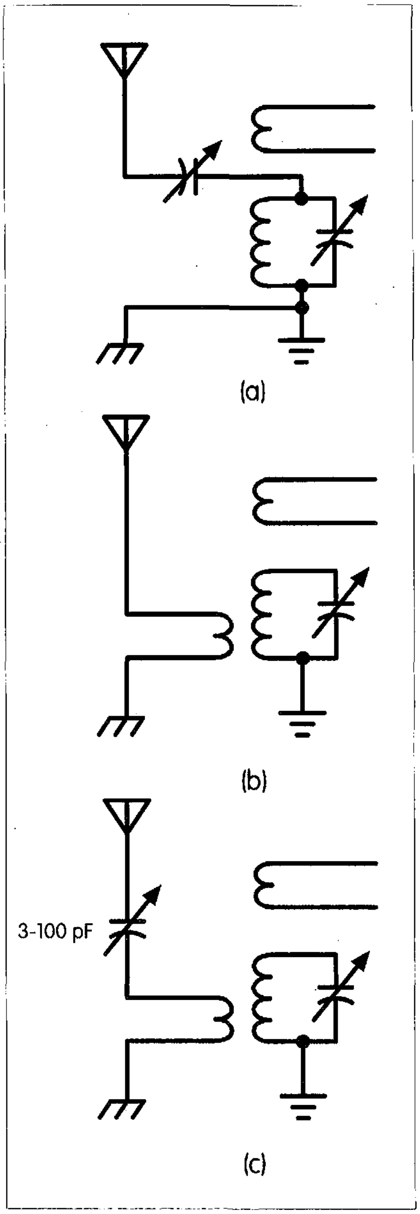


***Fig. 2.** Antenna circuit options. **2a** is preferable for relatively short antenna lengths (under 30 feet); **2b** is preferred for long antenna lengths (greater than 20 feet); and the addition of a series capacitor, **2c**, provides an antenna loading control.*

hand capacity effects are only noted when the radio is operated in the frequency range above about 10 MHz. Circuit options **3b** and **3c** were devised to eliminate the hand capacity effect, and as alternative methods of regeneration control. In **3b**, capacitor C_T functions as a variable reactor whose value is adjusted to create exactly the desired amount of desired regeneration. The capacitance value of C_T is typically in the range of 365 pF (maximum). The higher the adjusted capacity value, the more regeneration will be achieved. Circuit **3c** shows how the transistor collector current can be adjusted in order to control the regeneration. The higher the current, to a point, the greater the amount of regeneration that takes place.

After constructing the coils, it is necessary to phase the tickler coil in order to create feedback. The tickler coil ends may require reversing, if a squeal is not noted after adjusting the regeneration control. A regeneration squeal *should* occur after the ends of the tickler coil have been reversed. With the radio operating, the regeneration control is adjusted to provide sufficient feedback until a rush or a squeal is heard. The squeal will be most evident when a station is being tuned and the feedback is too high. When tuning a station, the amount of feedback may be reduced and then fussed with to obtain the recovery of modulation. Tuning an SSB station is the most fun, because of the critical adjustments required to obtain just the correct amount of frequency offset between

C = 200 pF max. (1-1/2-inch coil diameter)

F	L	No. Turns
250 kHz–800 kHz	2000 µH	380–425
800 kHz–2.5 MHz	200 µH	125
2.5 MHz–6.5 MHz	30 µH	40–50
6.5 MHz–18 MHz	3.5 µH	12–18

C = 365 pF max. (1-1/2-inch coil diameter)

F	L	No. Turns
100 kHz–400 kHz	5000 µH	450
400 kHz–2 MHz	350 µH	150–175
2 MHz–6 MHz	20 µH	35
6 MHz–18 MHz	2.5 µH	10–15

Table 2. *Coil chart values based upon frequency band and variable capacitor value (200 pF and 365 pF max. capacitance).*

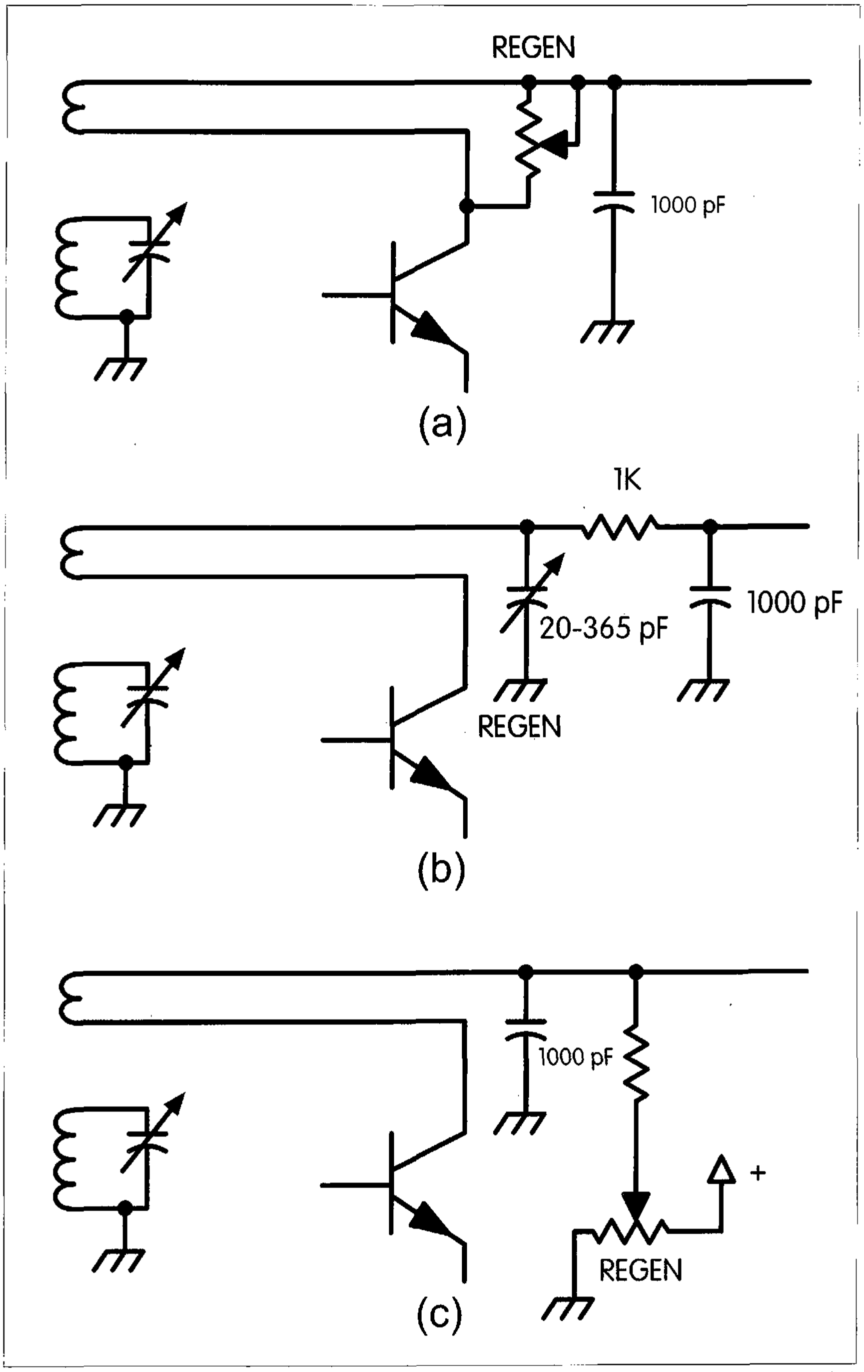


Fig. 3. *Methods used for controlling the amount of regeneration.* ***3a*** *shows a variable shunt;* ***3b*** *shows a reactance control using a variable capacitor;* ***3c*** *shows regeneration being controlled by a change in collector current.*

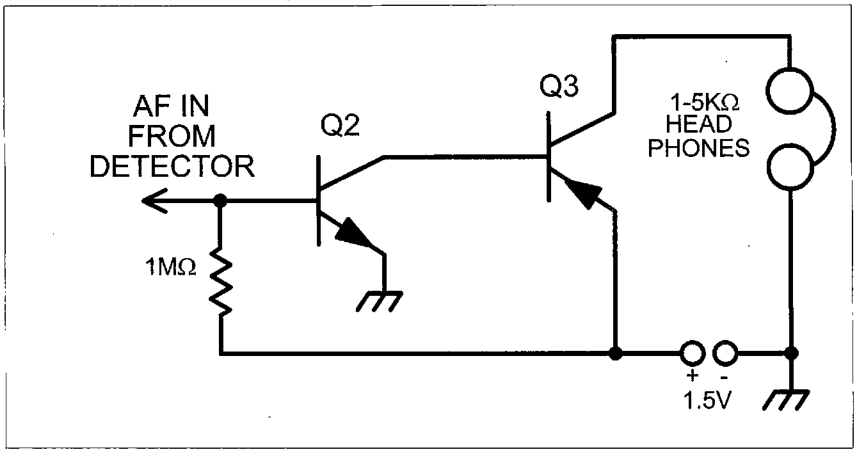


Fig. 4. Original direct-coupled audio amplifier used with the Fun Radio. Q2 can be 2N2222 or 2N4401; Q3: 2N525, 2N404, or 2N270.

the oscillator and the received signal. And of course, just as the audio is obtained, the stations will switch—requiring another adjustment. Be patient and the fun will prevail.

Construction

For the most part, circuit construction is simple and the components may be mounted in any desirable manner. Keeping the lead lengths short will enable high-frequency operation. Armstrong designed the circuit around a vacuum tube and the components were mounted on a flat piece of wood called a "breadboard." Although the circuit would work just as well when mounted on a breadboard, which would create a nostalgic flavor, it is usually more convenient to mount semiconductor circuits on printed circuit board material. The use of perforated board material is also commonly used. A mechanical layout is not provided here, but as a suggestion for a beginner, the mechanical layout should follow the schematic diagram, with parts placed/positioned about as shown. Placing the parts close without crowding is satisfactory for this project.

As a guide to winding the tuning and feedback coils, percentage values are given based upon the total number of turns used for "L" when operating below 18 MHz. (For use above 18 MHz, the amount of feedback used becomes critical and generally difficult to control. It then becomes necessary to reduce the number of turns on the tickler winding to improve control of the feedback.) If desired, the coils may be fixed for a single band of frequencies or may be made plug-in-style for multiple bands. The number of turns required for a specific band may be determined by trial, formula, charts, or from **Table 2**, and are selected to resonate with variable capacitor "C." The typical "C" value used in the Fun Radio is 365 pF, but any value from about 200–500 pF will work satisfactorily. Should a dual-section tuning capacitor be used, the two sections may be connected in parallel when operating on the lower frequency bands. The values shown in **Table 2** are divided into two sections and assume a coil diameter of one and one-half inches for use with either a 200 pF or 365 pF tuning capacitor. Coils may be wound using any wire size from #24 down to #46, laid down in a single-layer "close-wound" manner. A cardboard toilet paper or paper towel tube is approximately one and one-half inches in diameter, and is a common coil form used in the Fun Radio. Coating the tube with either varnish or plastic spray prior to coil winding is a good idea, to reduce the possibility of moisture absorption. Also, ferrite loopsticks work very well in the Fun Radio. Because of the iron permeability, fewer coil turns are required to cover the same frequency bands.

Audio output

Many options are available for audio output from the detector. The original design of the Fun Radio used a silicon NPN transistor, driving a germanium PNP transistor, as shown in **Fig. 4**, because it provided an adequate audio amplitude for driving a set of high impedance (1–5 kΩ) headphones from a 1.5 V source. If the Fun Radio is to be used to drive a speaker, it will be necessary to add a power amplifier IC, as shown in **Fig. 5**, which operates from a separate battery, say 9 V. However, the detector circuit will continue to operate from a 1.5 V source. The use of an LM386 is perhaps the easiest amplifier to implement, as it will drive a small

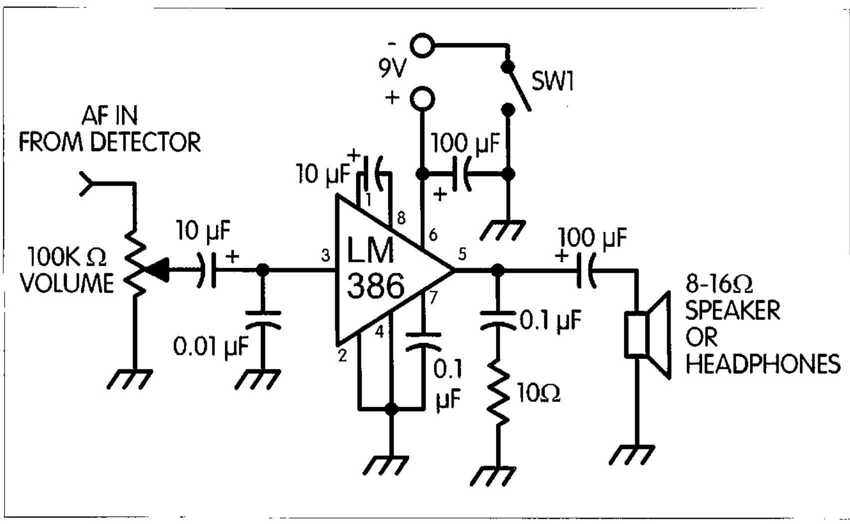


Fig. 5. Audio amplifier option to drive either a small speaker or low-impedance headphones.

Continued on page 79

Meet the Marvelous MicroVert

A 20-inch vertical for 20 meters?

Douglas E. Person W4DXV
10306 Yandem Court
Charlotte NC 28269
[W4DXV@IBM.NET]

Is this the world's smallest vertical antenna? Well, I'll admit that the MicroVert's claim to this title has not been well researched. There might be a smaller 20-meter vertical antenna out there, but I'll be very surprised if there is! The MicroVert measures in at an astonishing 20 inches tall and yet manages to cover the entire 20-meter band with an SWR no higher than 1.5:1. Amazing? Maybe. Interesting? Absolutely! Imagine the response you will get from other stations as you describe your antenna, all 20 inches of it!

Why the MicroVert?

Like many hams, I live in a deed-restricted housing development where antennas are not welcome. The solution to this situation is to employ antennas that do not attract the unwanted attention of "The Powers That Be" who enforce these restrictions. With this regrettable situation in mind, my interest in antennas has been focused lately on finding solutions for myself, and others like me, who live with these restrictions. The MicroVert represents one of these solutions (see **Photo A**).

If you are attempting to develop a radiator whose primary objective is stealth, size is an obvious starting point. Large antennas are difficult to conceal. Very small antennas are far easier to conceal, especially when they don't resemble antennas at all. The primary design objective for the MicroVert was "as small as possible." The result of this effort covers all of 20 meters with an SWR that will make almost any modern solid-state transceiver happy, and is so small that it can be truly classified as a "stealth" antenna.

A lesson remembered

In 1962, I built my first transmitter out of salvaged parts from a discarded TV set. I assembled a single tube and a pi-network output on an old radio chassis. With power applied and a few quick twists of the load and plate capacitors, the current dipped and I was on 40 meters CW. I made many fine contacts with this rather crude and unattractive piece of equipment. I was, however, soon to find my household operating privileges severely restricted. My little one-tube transmitter created a rather substantial amount of TVI. The solution was to rebuild the transmitter into a fully enclosed metal cabinet, which prevented the RF energy present

***Photo A.** The MicroVert is a little package with a big delivery.*

Parts List

Qty.	Description
2	CPVC 3/4" Tee
2	CPVC 3/4" 90° elbow
1	CPVC 3/4" end cap
1	3" x 4" piece of Plexiglas™
1	10" x 3/4" section copper mending pipe
1	12" fine-threaded brass rod
4	fine-threaded brass nuts
1	3/4" diameter nylon bushing
23 ft.	#12 solid copper insulated electrical wire
1	SO-239
1	6' x 3/4" aluminum tube

Table 1. *Construction materials for the MicroVert antenna.*

in the tank circuit from escaping and interfering with my mother's soap operas.

The lesson was learned and remembered. The MicroVert is simply the recreation of the tunable output circuit of that little 40-meter transmitter, enhanced in such a way that it radiates as much RF as possible.

The MicroVert is, in fact, nothing more than a series-resonant circuit with a Q low enough to cover all of the 20-meter band.

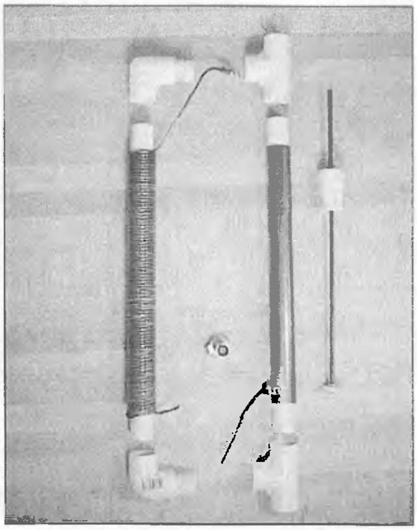


Photo B. *MicroVert parts are easy to find and assemble.*

Building a MicroVert

The MicroVert is easy to build. All of the parts you need can be obtained from your local home improvement center. **Table 1** provides a parts list for your shopping convenience (see also **Photo B**).

The plastic pipe used is chlorinated polyvinyl chloride (CPVC), which is normally used in place of copper pipes for household plumbing. I chose this material because its dimensions were ideal for this project. It is not the best material for this use because its insulating properties leave a little to be desired, but it is readily available and easy to work with, and mates perfectly with the copper pipe that forms part of the tubular capacitor providing the "C" in the series LC circuit. In my final version of the MicroVert, I substituted a section of Fiberglas™ tubing for the CPVC coil form. This change greatly improved power-handling capability and is a recommended upgrade for those moving beyond the experimenting stage.

I found the nylon bushing in the specialty hardware section. This particular item is meant to be used on furniture as a washer placed beneath a large screw head to protect the wood. A suitable replacement can be made from any sort of plastic material.

The MicroVert consists of two main components:

1) An inductor, made up of common solid 12-gauge electrical wire wrapped on a 12-inch section of 3/4-inch CPVC pipe; and

2) A capacitor, made up of a 10-inch piece of copper pipe held in place over another 12-inch piece of CPVC, with a threaded brass rod mounted in such a way that it can be threaded into and out of the copper pipe—raising and lowering the "C" value respectively.

Let's take a tour of the MicroVert, starting and ending with the feedpoint—your coax connection.

The feedpoint

A small rectangular piece of acrylic plastic or Plexiglas™ supports the SO-239 coax connector. I recommend using the type of SO-239 that is held in place with a single large nut and washer, rather than the more common type that requires at least two additional small screw holes to be drilled. Either will work, but the plastic is brittle, and the fewer holes that need to be drilled, the better. The washer supplied with the nut-mounted SO-239 has a convenient solder tab, which simplifies attaching the jumper (described below). The plastic rectangle is then attached to the bottom of the antenna with self-tapping screws or is simply glued to the assembly.

The inductor

The center of the SO-239 is connected to the bottom of the inductor. The inductor, consisting of 20 feet, nine inches of solid 12-gauge insulated wire, occupies 10 inches of the 12-inch CPVC pipe used as the coil form. The remaining area of the pipe is used to slip into the two elbows that hold the inductor in place. The top of the inductor is connected with a jumper wire to the threaded brass rod. The jumper wire has a large plated lug soldered to it, which facilitates a good electrical connection to the threaded brass rod.

Winding 20 feet of 12-gauge solid copper wire onto a one-inch diameter form is a challenge. The method I used was to drill two 3/16-inch holes one inch in from each end of the form. I clamped one end of the coiled wire into a bench vise and unrolled the wire onto my garage floor as I backed away from the vise. With the wire fully unrolled, I threaded the loose end of the wire through one of the holes in the form, leaving about six inches free. Pulling the wire tight, I then walked toward the vise, simultaneously pulling the wire taut and rolling it slowly onto the form. When the wire was fully wound on the CPVC pipe, I took a firm grip on the wire at the top of the form to keep it tightly wound and then worked the free end through the remaining hole.

The capacitor

The capacitor consists of two parts: a 10-inch copper pipe and a 12-inch threaded brass rod. The threaded brass

rod is held in place by two brass nuts supported by brass washers. The lower nut is glued into the inner surface of a three-quarter-inch CPVC end cap along with a washer placed underneath it against the cap's surface. With the rod threaded into the fixed nut, another nut is threaded down to compress two additional washers that secure the jumper wire from the inductor.

On the tip of the brass rod that extends into the copper pipe is a three-quarter-inch nylon bushing held in place with two brass nuts. The nylon bushing provides a reasonably tight fit inside the CPVC pipe, providing precise alignment of the brass rod. The 10-inch section of copper pipe provides the surface area for the capacitor. A substantial portion of the capacitance required for the "C" component is actually derived from the pipe's close proximity to the inductor. The spacing between these two components is critical and should not be altered without due consideration.

The copper pipe used is a special type available in most plumbing departments. It is normally used for splicing two sections of regular copper pipe together. As such, its inner diameter is just large enough to slip over the ends of the pipes to be joined. Since the CPVC pipe is exactly the same outer diameter as the copper pipe, the larger joiner pipe fits over it perfectly as well. The copper pipe is cut to a length of 10 inches, positioned directly opposite the inductor, and secured in place with a self-tapping sheet metal screw positioned half an inch from the bottom.

The sheet metal screw is also used to provide a connection point for a short jumper wire that goes from the bottom of the copper pipe to the shield side of the SO-239. The jumper is made of the same 12-gauge wire as the inductor and has a good-quality plated lug soldered to it. The area of the pipe in contact with the lug is burnished with steel wool or light sandpaper to improve the connection quality. As a final assembly step, consider soldering the jumper's lug directly to the copper pipe.

While two elbows support the inductor's coil form, the capacitor's section of pipe is supported with two

Ts. The top T is used to mount the threaded rod. A one and one-half-inch piece of pipe is used to join the end cap to the top of the T. The rod is inserted into the capacitor and held in place with just the friction grip of the various pieces.

Combining the "L" and "C"

The capacitor and inductor sections are held together to form a rigid "O" with two one and one-half-inch sections of CPVC pipe. These are used to connect between the Ts of the capacitor and the elbows of the inductor. The pieces all fit together very tightly and it is unlikely that any further steps are needed to hold the MicroVert together. If desired, however, you may elect to use the special solvent glue normally used to bond CPVC on the connection points to make your MicroVert even stronger.

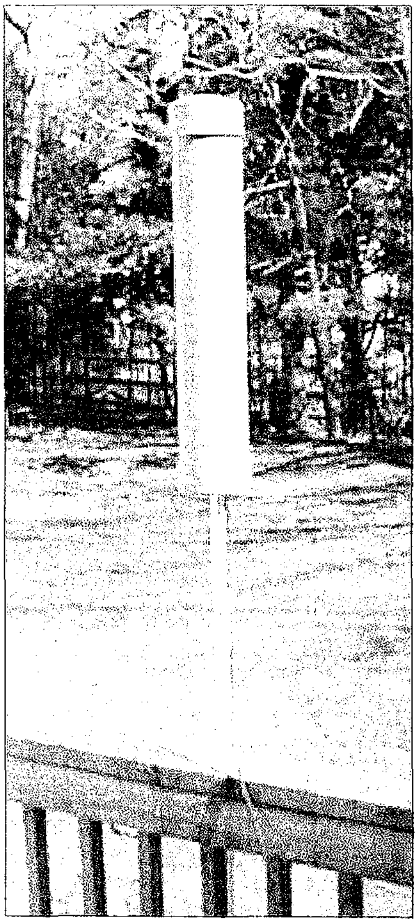


Photo C. *"Oh, that's just our new ... uh ... birdfeeder ... yeah, birdfeeder."*

A counterpoise

I found that by using a short counterpoise, the MicroVert tuned more easily and was more stable. In my final configuration, the MicroVert is mounted on an eight-foot length of three-quarter-inch aluminum mill tube. By placing a jumper between the shield side of the SO-239 and the aluminum tube, I obtained just enough counterpoise to make the MicroVert happy. I used some scrap 14-gauge stranded electrical wire to make the jumper. I soldered one end to the shield side of the SO-239 and the other end to a lug, which I then clamped against the mast with a stainless steel hose clamp.

As an alternative, you can employ one or more lengths of wire as a counterpoise. I have not experimented with more elaborate counterpoise systems and therefore cannot provide any insight into how this would affect the performance of the MicroVert. However, I would be interested in hearing from anyone who tries this.

Tuning the MicroVert

Tuneup is easy. Move the threaded rod to the top of its travel. Check the MicroVert's SWR. (I used an MFJ-209 antenna analyzer, a rather indispensable tool if you spend a lot of time fooling with antennas.) The resonant point should be above the 20-meter band. Thread the brass rod in three or four turns at a time until minimum SWR occurs at 14.175. You should then observe an SWR no higher than 1.5:1 at the band edges.

Operating with the MicroVert

After completing the first MicroVert and determining that it did indeed resonate in the 20-meter band, I was eager to get it mounted outside and give it a try. I lashed the six-foot mast to the deck railing and ran the coax back to the ham shack. The MicroVert was about 12 feet above the ground. I found a couple of gentlemen having an easygoing chat and decided to break in and ask for a signal report. I received a 5/5 and 5/7. They were somewhat incredulous when I described my antenna. After chatting about it for a few minutes, another station broke in to ask a question about the MicroVert. For the next 15 minutes I was kept busy handling a mini-pileup as one station after another wanted to know more about the 20-inch vertical I was using. Success like this is very gratifying.

Additional notes

Some CPVC material appears to be less than perfect as an insulating material. As a result, the section of CPVC pipe used for the inductor can alter the resonance when subjected to 100 watts of carrier for more than a few seconds. I have found that the CPVC material will perform adequately under normal SSB operation of 100 watts or less. As mentioned earlier, after substituting a section of Fiberglas tubing of suitable diameter for the inductor's coil form, this instability appears to have been greatly reduced.

The MicroVert appears to be affected by moisture. During a rainstorm, I noted that the SWR increased. To protect the MicroVert from the weather, I made a rain cover out of four-inch PVC irrigation pipe. I used about 24 inches of pipe and two end caps to create an attractive cover for the MicroVert. The pipe was a nice shade of green and, when mounted in the back yard, looked more like a birdhouse or birdfeeder than a radio antenna (see **Photo C**).

One very important requirement for success with the MicroVert is a quality earth ground on your transceiver. A good ground is an essential element in any good station setup, but without one, the MicroVert will be very unstable and is not likely to load properly.

Conclusions

The MicroVert does work. How well it works compared with other antennas is another matter. The MicroVert should be considered a specialized application—if you have room for a full-size 20-meter dipole, then that is your best option. But if you, like so many hams, are severely limited by space and/or deed restrictions, the MicroVert might be the difference between getting

Continued on page 48

Home-Brew This Power Cube

First step in rebuilding your vintage RF deck.

Ronald Lumachi W2CQM
73 Bay 26th Street
Brooklyn NY 11214-3905
[W2CQM@juno.com]

If you'd like to see a subtle trend developing in the ham radio community, take a look at the number of classified advertisements being placed by hams who are looking to buy *broken* HF amplifiers. Contrary to what you might think, these guys, prowling with predatory stealth in the quest for these long-forgotten junkers, are not going off the deep end. Nor, by any stretch of the imagination, have they lost their grip on reality.

They are, in fact, part of a growing number of astute home-brewers who have independently concluded that the shortage of linear amplifier components will only get worse and that they had better search out a new source of supply. They recognized that this older category of gear, languishing in garages and attics, is a veritable storehouse of components. And, with a little work, some replacement parts, and a few circuit updates, many of these older units have the potential to be powerhouse amplifiers equal to the best on the market.

This equipment, currently relegated to junk pile inventories, has been crossed off and for the most part forgotten by those who are either comfortable with the more modern store-bought amps or who are simply not interested in any construction projects. Consequently, as long as the current owners consider the vintage gear obsolete and of minimal value, bargains will continue to surface for those horsetrader sharpies making their quiet deals.

Look closely at this developing phenomenon and it's easy to understand how these renaissance builders arrived at the conclusion that *old is good* (and, more often than not, better than new). For example, after deciding on a home-brew building project, they find that sticker shock sets in immediately after pricing parts from the ever-decreasing number of quality catalog retailers. Furthermore, many wannabe builders have become disappointed with the results of fruitless experiences at hamfests, trying to scrounge for amplifier components.

Almost by default, they have concluded that the older rigs are an untapped resource. If they were parted out and sold, the worth of their components would substantially exceed the market value of the unit itself. Fortunately for the traders, this value is not (as yet) fully appreciated by current owners.

It is clear to "renaissance builders" that the chassis and cabinet is a gold mine in its own right. To prove the point, price out a new enclosure and see what I mean! Additionally, the deck and power supply are replete with many high quality components (see **Photo A**). They have the potential for quick and easy updating to the standards

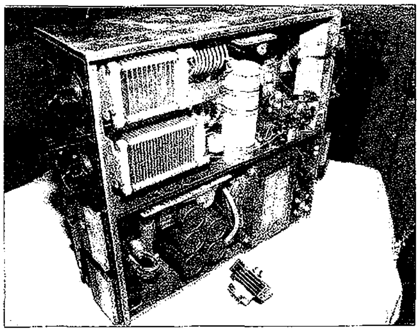


Photo A. *Take a look at a classic example of a 10–160 m linear amplifier loaded with components but cast aside because of that little $1000 replacement fellow in the foreground. The small footprint of the Dentron MLA2500 lends itself to re-tubing, however. Plans for this unit include the removal of the tank circuit and capacitors (for another day and time) and setting up the unit for a monoband six-meter amplifier using a single 3CX800A7.*

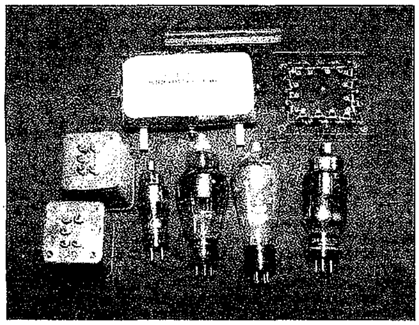


Photo B. *Some old, glow-in-the-dark, gas-filled rectifier friends contrast with the solid state bridge replacement rectifier. Either of the upper power cubes replaces four of the rectifier tubes (816, 866, 866, 3B28) and a slew of filament transformers. What a great trade-off when updating a vintage rig.*

of the newer, more modern, but very expensive equipment.

With those revelations taken to the next logical step, what followed is simply history. Advertisements began to appear in the classified sections of ham radio publications to search out likely candidates for amp rebuilding. Postings were made to those Internet groups and packet bulletin boards whose subscribers were most likely to have these items collecting dust. "*Wants*" were made known on all the horsetraders and swap nets that proliferate on the ham bands (see the article "Horsetrading on the Ham Bands" in the June edition of *73 Magazine*, 1997). If you need more conclusive evidence of the frenzied feeding of these amplifier-builder folks, check out Old Tom's (KAØHYZ) morning group, The Old Gear and Amplifier Builders Net, on 7.275 kHz Saturdays at 0930 EST. Their weekly wheeling and dealing goes on for several hours.

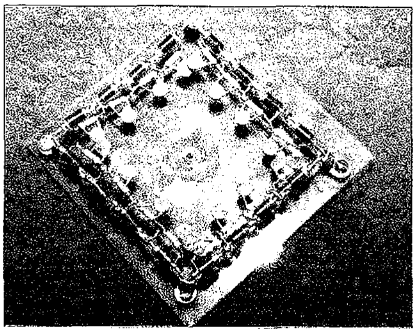


Photo C. *A close-up of the full-wave bridge circuit. Diode orientation is critical. Pay particular attention to the banding. Each corner is terminated in a solder lug and through-bolted to the Plexiglas. Note the capacitor/resistor transient suppressors soldered across each diode.*

For the prudent amateur newly aware of the trend, the question naturally arises, "How can you explain so much equipment being overlooked by so many knowledgeable hams?" The answer is simple. Take a look at the basic characteristics of these vintage units—and you can see why they were relegated to the back burner. At first glance, the dated and bloated low-output, heat-generating, glow-in-the-dark tubes have long ago been upstaged by more modern, compact, high-energy ceramic replacements.

The four-tube full-wave bridge rectifier, with its bulbous mercury- and gas-filled 816s, 866s, and 3B28s (see **Photo B**), along with its supporting array of multiple-filament transformers (hard-wired together with a rat's nest of complex point-to-point wiring), has long since passed into oblivion. The low-output HV center-tapped transformer, huffing and puffing along to squeak out 1800 VDC at 400–500 mA, is way out of its class in stark comparison to the Peter Dahl Hypersils pushing the envelope at mach speeds.

For these reasons (and others), many hams stuck these circa 1960–1980 boat anchor relics under the bench or buried them in the attic to collect dust. Out came the catalogs and checkbooks and the guys moved on to the more modern and exotic pieces of gear with all their bells and whistles. In the regular course of amateur radio events, that would normally be the end of the story, except that an ever-growing group of equipment sharpies have taken a more critical look at those old buckets of bolts. That small army of hams, excited about the idea of building up a custom high-quality legal-limit-plus amplifier, at dirt cheap prices, has developed a completely different mindset for that gear. They looked beyond the obvious and assessed the quality of the chassis and cabinet. They realized that with some trashing of the old, and the reshuffling of what remains, both the parts procurement process and the project are well underway with the purchase of a vintage amplifier.

With the addition of some newer components to that old relic, an amplifier, like the phoenix, will rise from the ashes and stand alongside the big boys, with a brand-new lease on life. What a deal! But don't go away, there's more! Like the cat that ate the canary, the new breed of builder looks with satisfaction at the quality of the jeweled and dampened meter movements, the heavy silver-plated tank circuits, the mil-spec bandswitches, and the relays. He assesses the myriad of unglamorous but essential capacitors, power supply components, and hardware, and realizes that ferreting out these remnants from the scrap heap is far from being absurd or pointless.

What's particularly interesting in this whole deal is that the more modern, but critical, parts needed for updating are not too difficult to locate. Heavy-duty solid state diodes (more on that in a minute), vacuum plate and tuning capacitors, new technology transformers, and rapid switching vacuum relays are around in ample supply at "reasonable" prices.

Two obvious questions arise

"Where do I begin the search?" "Should I buy the deck or the components first?" Probably the safest thing to do is to first locate an old linear as a base with which to begin the project. Hit the hamfest circuit with your new eagle-eye perspective. Let your fingers do the walking on the Internet or packet bulletin boards. Don't hesitate to list your wants. Place a couple of paid advertisements in the ham magazines and the biweekly mailing services. Be patient but persevere!

I've found that the RF deck of the B&W LPA-1 (pair of 813s) and a long array of SB series (200, 210, 220, 1000) Heath packages are good choices at realistic prices. A friend suggested the Johnson Viking Thunderbolt if one could be found. Even the Dentron MLA2500 (no one wants these clunkers because of their outrageously high cost for replacement finals) is a good choice

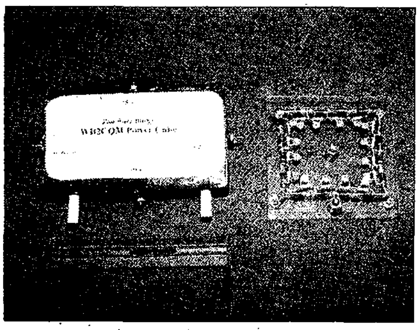


Photo D. Two renderings of the full-wave bridge power cubes. The fully resin-encapsulated unit on the left is fitted with nut/bolt attachment points. The two porcelain standoffs on the B- side are chassis-mounting assistants. The unit to the right has the bridge components sandwiched between two sheets of clear Plexiglas. The two standoffs pictured at the middle and bottom of the plastic sheets provide the necessary spacing. A small "L" bracket is all that is needed for mounting.

if compactness is a requirement and you're planning to change the tube lineup.

In my case, I recently swapped a two-meter HT and some accessories for that Dentron model. I plan a dedicated six-meter linear built around an Eimac 3CX800A7 spare I had on the shelf. If 160 m is a consideration, that whittles down the amplifier choices considerably. This low band frequency has come into favor only recently and generally is not found on the older rigs. However, keep in mind that there's always the possibility of adding that band with some modifications to the output circuit. More on that later, especially if you're able to locate a B&W deck with the integral coil/switch 850A tank circuit installed.

As another possibility: Keep an eye peeled for a smoked Henry 2K (the one with the pair of 3-400s) floor model. This vintage rig is particularly interesting because it exhibits a classic beauty coupled with an air of quality not duplicated in today's modern gear. In addition, there's plenty of space in the base for any and all super power supply updates and ample room in the RF deck component for a multiple tube installation. I recently purchased a 2K-3 in pristine condition that I plan to revamp with a pair of 8877s. The problem is that I must gather the fortitude to trash the unit. Admittedly, it's easier said than done!

Begin with the rectifier bridge circuit

All projects begin with the first step, so let's take a look at updating the old rectifier circuit with a full-wave bridge power cube (see **Photos C** and **D**). Traditionally, this component has been the least glamorous and most taken for granted part of a linear amp project, although it is often critical and more often than not the unsung hero of the whole undertaking.

With that in mind, let's give it some serious consideration. The main solid-state rectifier component, rated at 1000 VDC at one amp, is available from a variety of retail sources at about 15 cents each when purchased in bulk. Keep in mind that only a handful of these diodes will be replacing four tubes and an array of transformers. Think of all the space and efficiency you're gaining.

It's a good idea to buy at least double the number of diodes you'll need in order to select those with similar front-to-back electrical characteristics. Use your diode scale on the digital multimeter to sort them by value. You'll find that manufacturing tolerances have been tightened up so plus/minus deviations may vary only slightly. With that in mind, you may decide not to install the resistor/capacitor combination bridged across each diode to smooth out any transients.

However, my advice is to install them as an extra measure of insurance against a Murphy's Law breakdown. If our experiences are similar, things that can go wrong will go awry at the least opportune time. Besides, each capacitor/resistor combo will set you back only 25 cents. If you go the whole route with 16 diodes coupled to 16 transient suppressors, the total cost will be less than $7.00. There's not much more to say about which direction to take!

The building of the bridge is rather straightforward. Each of the four legs is assembled separately. Lay out a string of four diodes so that the bands and arrows are oriented and pointing

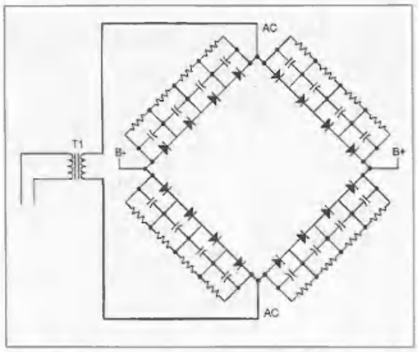


Fig. 1. Schematic. Resistors are 390 k, 1/2 W. Diodes are 1 A, 1000 PRV. Capacitors are 0.01 μF 1000V. 3 A diodes #1N5408 are available at slightly higher prices.

in the same direction. Before series-soldering one component in the string to another, a provision for mechanically linking each diode makes good sense. Small hooks can be formed in each of the shortened leads and crimped to secure the bond. If you prefer, only the crimp end cut from a solder lug may be used to make the bond prior to soldering (see **Photo C**).

Parallel the lead of a 390 k 1/2 W resistor across a 0.01 μF disc capacitor (1000 VDC). Series-connect four resistor/capacitor combinations and place them across each diode in the string. Give each lead a twist around the mechanical bond of the diodes, clip off any excess, and solder the assembly in place.

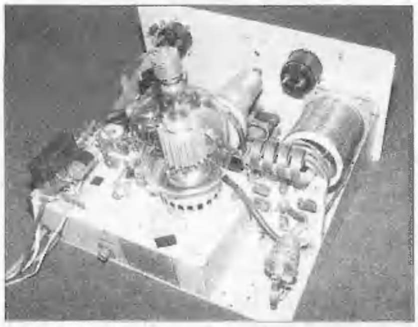


Photo E. *The rear view of a partially refurbished B&W LPA-1 RF deck. Holes in the original (raised) chassis have been blocked and a 4-1000A mounted in the place of two 813s. Note the rebuilt B&W 850A tank circuit to the right boasting the addition of 160 m. A vacuum variable is sitting in front of the tube and the antenna tuning capacitor is positioned below. Immediately to the left of the tube is a vacuum relay. Small transformer at left powers the 26 VDC relays used throughout.*

In the next step, pay strict attention to the polarity of the diodes with respect to the other components. Following the standard full-wave bridge schematic (see **Fig. 1**), connect up the four strings of diodes. Mark your plus (+) and minus (-) points with dabs of red and black paint, respectively. Mark the two AC input points with white paint. Use a mechanical bond before soldering at the four junction points.

It's a good idea to include some provision for tying the unit into the high-voltage circuit. You can use a bolt or a solder lug. The next choice to make is how best to package the bridge for both easy and safe handling. Of course, the component package can be simply wired into the circuit with no further considerations. The bridge may also be encapsulated in about 16 ounces of resin (available at a marine supply) or framed in a clear Plexiglas™ enclosure by using standoffs (see **Photo D**). The choice is yours, and at this point it's strictly a question of aesthetics. There's no performance advantage with either method.

One down, a couple more to go!

With the completion of the power supply cube, the rebuilding process is well underway. Keep alert for that new-generation transformer that will provide that extra kVA punch. Shop around for a pair of SPDT high-speed vacuum relays for the internal antenna switching. Select from an array of new-generation finals what best fits your budget. If you're fortunate, the original filament transformer in the vintage rig can do double duty for you in the new tube lineup, but don't make that a critical element in your choice of a final tube. Filament transformers in all voltages are readily available at moderate prices. If you want to get it right the first time, don't compromise. Take whatever time you need, but buy exactly the right component.

If you were able to locate a vintage amplifier with a 10–80 m B&W 850A as a tank circuit, the addition of 160 m is a relatively easy modification (see **Photo E**). Simply remove the 40–80 meter portion of the coil (#8 copper wire) and replace it with a four-inch

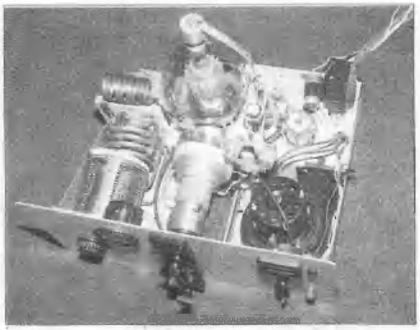


Photo F. *Front/elevated view of the 4-1000A. The larger fan to the right provides cooling air to the pressurized chassis. A turns counter keep tabs on the plate tuning capacitor position. The meter to the right now reads relative RF power output. The newly installed meter to the left monitors grid current.*

home-brew coil wound with 6 TPI #10 solid copper wire. The overall length of the coil is approximately three and three-quarters inches—it will shoehorn into the space of the old coil.

The 22 to 24 feet of coiled wire will net approximately 28 μH, which is more than enough to tune the entire band. One or two of the original "L" brackets can be used to support the far

Continued on page 48

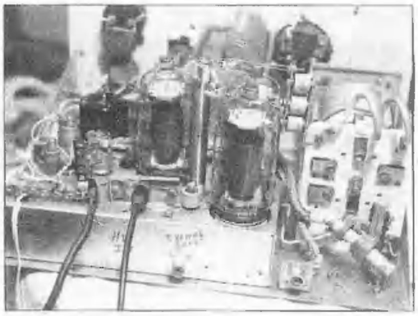


Photo G. *View of a partially modified B&W LPA-1 with an additional 813 installed. Note the parts placement layout's similarity to that of the 4-1000A unit. In this installation, the tune and load capacitors along with the tank circuit have been maintained in their original position. This unit mounts the stock 10–80-meter coil along with the original fan. Two SPDT vacuum relays (one pictured to the left of the 813) have replaced the open frame relay. The other relay is installed within the chassis. A separate solid-state power supply delivers 3200 VDC at 600 mA and filament voltages via umbilicals to the deck.*

Techno-Trouble II

All right, let's see how you do with these.

Steve Katz WB2WIK/6
21101 Celtic Street
Chatsworth CA 91311

In the April issue, we introduced "Techno-Trouble for Know-It-Alls." How did you do?

Here are fifty more semi-technical posers to further stretch that gray matter.

1. On 20 meters, an important attribute for any good receiver is noise figure. **T/F**

2. Reducing your transmission line loss by 3 dB results in a 6 dB station performance improvement. **T/F**

3. A well-optimized three-element yagi offers about 10 dBd gain. **T/F**

4. The "no ground radials required" verticals are ground-independent. **T/F**

5. Electrical and thermal conductivity are related. **T/F**

6. There is substantial evidence that vertically-polarized beam antennas require special feedline routing consideration for optimum performance. **T/F**

7. Aluminum is an ideal conductor for RF applications—that's why we make our antennas of aluminum! **T/F**

8. Doubling the wall thickness of an antenna support mast doubles its strength; the thicker, the better. **T/F**

9. Doubling the diameter of an antenna support mast cubes its strength. **T/F**

10. A very good boom material for VHF/UHF beam antennas would be bamboo. **T/F**

11. Teflon™ coaxial cables are best because they have the lowest loss. **T/F**

12. There is a direct correlation between velocity factor of propagation (VF) and coaxial cable attenuation. **T/F**

13. Nitrogen-filled coaxial cables have extremely low loss because nitrogen is the best RF dielectric material. **T/F**

14. DSP (digital signal processing) is better than using IF filters to improve receiver performance. **T/F**

15. When your VHF receiver loses sensitivity due to nearby strong signals that create terrible interference, this is a sure sign of "intermod." **T/F**

16. The best way to handle "intermod" from high-powered pagers and commercial repeaters on VHF is to use a "cavity" between your antenna and receiver. **T/F**

17. The range of Personal Communications Service two-way radios can be greatly extended by connecting them to large outdoor antenna systems. **T/F**

18. Cellular telephone service antennas are generally installed along highways and in populated areas, not on mountaintops. **T/F**

19. It is possible for a VHF radio system or antenna to be "too high." **T/F**

20. A 160-meter dipole antenna lying on the ground is insufficient to make many contacts! **T/F**

21. The "through-the-glass" two-meter antennas work about the same as a whip mounted on the roof of the same vehicle. **T/F**

22. Ten watts output power on CW will produce about the same received signal to noise ratio (readability) at a distant location as 100 W output power on SSB, or 400 W output power on FM. **T/F**

23. Operating CW mobile is so crazy, almost nobody does it. **T/F**

24. CW is a "dead" mode, used mostly by die-hard geriatrics. **T/F**

25. The highest point in the "Lower 48" east of the Mississippi River is Mt. Washington, NH. **T/F**

26. The highest point in the "Lower 48" west of the Mississippi River is Mt. Whitney, CA. **T/F**

27. California has both the highest and lowest points in the contiguous United States, and those two points are only 100 miles apart. **T/F**

28. It would be nice if signals could be "bounced" off man-made "reflector clouds" in the sky; this is an interesting theory that bears investigation. **T/F**

29. Standard video signals can be transferred via the Internet using telephone modems. **T/F**

30. "Long path" signals on HF are weaker than "short path" signals. **T/F**

31. The North Pole would be a great place to operate HF, because it is a "short path" point to most of the Northern Hemisphere. **T/F**

32. Stacking identical beams provides 3 dB gain in the favored direction over one of the single antennas. **T/F**

33. 9913 is great coaxial cable to use for most VHF/UHF applications. **T/F**

34. LMR400 is great coaxial cable to use for most VHF/UHF applications. **T/F**

35. Type N, type C, and type BNC connectors were all developed at Bell Telephone Laboratories, 50 years ago. **T/F**

36. Bell Telephone Laboratories is now called Lucent Technologies. **T/F**

37. The inventor of the transistor was a ham. **T/F**

38. One of the co-inventors of the Touch-Tone™ telephone system was a ham. **T/F**

39. Hams helped prove the following things were possible: transoceanic communications; moonbounce; microwave parametric amplifiers. **T/F**

40. Nobody has ever worked DXCC (contacts with 100 countries, confirmed) on six meters. **T/F**

41. Being "line of sight" to a station of VHF is more important than just being in close proximity, regarding signal strength. **T/F**

42. Diction and enunciation, aided by excellent signal linearity, will be of more help in making a contact better on SSB than will signal strength. **T/F**

43. At 40+ years old, the Collins 75A4 receiver outperforms many modern receivers built in 1998 when it comes to the ability to copy weak signals adjacent to very strong ones. **T/F**

44. A good low-pass filter installed on your six-meter transmitter will be a great asset in eliminating or reducing TVI (television interference) on TV channel 2. **T/F**

45. Just show up at the ARRL club station, W1AW, and you can operate it to your heart's content. **T/F**

46. If you are "single op" contesting in the major HF contests, one way to help "win" is to call CQ on one band while making contacts on another band. **T/F**

47. If you want to win the November Sweepstakes (SS), change bands every few minutes, to optimize your contacts per hour rate. **T/F**

48. Six meters (50 MHz) doesn't "open" during the winter—it's a "summertime" band for making long-distance contacts. **T/F**

49. Lightning storms "open" the six-meter band because lightning ionizes the E-layer, creating opportunities for "skip" propagation. **T/F**

50. The "K" and "A" index are not critical indicators for 160-meter propagation. **T/F**

Easy ones, huh? Check your results. The answers appear below:

1. *False.* Atmospheric noise will override receiver-generated noise in all but the very worst receiving equipment.

2. *True.* 3 dB improvement on transmit, 3 dB on receive.

3. *False.* A yagi design using three optimally-spaced elements cannot provide more than 7 dBd gain.

4. *False.* Everything is ground-dependent. Why do the manufacturers provide tuning instructions for various heights above ground?

5. *True,* for conductors. *False,* for insulators! (Trick question.) For example, Beryllium oxide, an excellent insulator, has almost the same thermal conductivity as aluminum.

6. *True.* Big time!

7. *False.* Aluminum is a good conductor, but its oxide is a great insulator. And it is nonconforming with regard to thermal expansion properties, making it difficult to connect to, other than temporarily.

8. *False.* See #9.

9. *True!* Mast diameter is much more important than wall thickness. Of course, material used is important, too.

10. *True.* This natural material, cheap and lightweight, is very strong and an excellent RF dielectric material.

11. *False.* Teflon cables are great, but not because they have lower loss. Their loss is equivalent to conventional polyethylene dielectric cables, as is velocity factor. Teflon's main advantages are mechanical strength and thermal survivability.

12. *True.* But they are inversely proportional.

13. *False.* Nitrogen is used because it is reasonably inert, not terribly expensive, noncombustible, and readily available as a "dry" (not containing any water vapor or other conductive contaminants) element.

14. *False.* DSP is great but won't prevent your receiver from desensitizing or intermodulating signals within its IF passband. A combination of excellent IF filtering and DSP is preferred with current technology, at least until RF DSP (employed at the operating frequency) emerges.

15. *False.* This is desensitization. Intermodulation is a very different thing.

16. *False.* At least usually. Cavity filters are huge, expensive, critically-tuned, and don't allow you to change frequency without retuning. Notch filters, tuned to the offending pager or commercial repeater frequency, are far more effective—not to mention economical—for this application.

17. *True.* Unfortunately, this is illegal!

18. *True.* The cellular telephone service was designed to have very small "cells." Mountaintop sites violate this principle and actually hinder operation of the system.

19. *True.* Especially true if the system is installed above the tropospheric height (which varies constantly) at the time.

20. *False.* Contacts can be made successfully at these low frequencies with wire antennas literally lying on the ground; however, the resonant frequency of such an antenna will be very different from "free space." Higher antennas will, of course, work better.

21. *False.* Automobile window glass is not a good RF dielectric in the VHF spectrum. Roof-mounted antennas normally work much better.

22. *True.*

23. *False.* In fact, it's becoming

more popular all the time, and there are dozens of HF "mobile CW" nets which are quite active.

24. *False*. CW still represents approximately 37% of all HF activity.

25. *True*.

26. *True*.

27. *True*. Hard to believe, though, huh?

28. *True,* but this is a trick question. Actually, it's been done many times. NASA initiated such experimentation 30 years ago. The author was part of one such experiment, when an RF cloud was launched from Wallops Island, VA. It created a "band opening" on two meters from Maine to Florida for several days!

29. *False*. (Sob.) Analog telephone lines (POTS lines) cannot support video, as their bandwidth is too limited. ISDN (digital) lines get us about halfway there, but to support video that "doesn't blink," T1 appears the minimum network system. "Cable" modems should help a lot as they become popular.

30. *False*. Frequently, long-path signals are much stronger than short-path. Depends on propagation variables, local terrain, etc.

31. *False*. Operations from the North Pole, beginning with NP1 (K2BPP) about 20 years ago, have proven otherwise. It seems a horrible place from which to operate.

32. *False*. But this was a trick question, too. On microwaves, where ground reflections and propagation variables are minimized, 3 dB appears about correct. But at lower frequencies, this varies a great deal, from <3 dB to >3 dB, depending on the path. In the author's experience, at frequencies <54 MHz, the actual improvement is normally >3 dB, normalized over the period of an average contact.

33. *False*. In some applications (straight cable runs with no bends, no rotations, etc.), 9913 is a wonderful product. In most amateur home-station applications, its use is almost prohibited by the environment, which might require small-radius bends or repeated flexing that severely damages cables of this construction.

34. *False*. Like 9913 (see #33, above), this cable is too inflexible for ordinary work. Worse, LMR400 has a copperclad aluminum center conductor, which, if scored through the thin copper cladding during connector installation, becomes too much of a variable for reliable operation. The author has literally burned through the copperclad aluminum center conductor by operating at 1000 W, at 144 MHz, for 15 minutes into a resistive "dummy" load. Not my idea of a good time.

35. *True*.

36. *True*.

37. *False*. The Nobel-prize winning team were not hams.

38. *True*. Bayman McWhan W2GAX (SK).

39. *True!* Cool, huh?

40. *False*. It's been done many times.

41. *False*. They are both important, but other things being equal, proximity rules.

42. *True*. Proven countless times by QRP operators who "eat the lunch" of high-powered stations with poor diction.

43. *True*. Reason is, all-analog design (no single-sideband phase noise to speak of), great IF filtering, and well optimized signal processing through the RF amplifier and mixers. A real classic.

44. *False*. (Sob, again.) Six meters (50–54 MHz) is so close to TV Channel 2 (immediately above six meters and directly adjacent to the band) that

Continued on page 48

Number 32 on your Feedback card

Yaesu's VX-1R Micro Dual-band HT

Pluses and minuses, big and little—er, tiny.

Michael Geier KB1UM
c/o *73 Magazine*
70 Route 202 North
Peterborough NH 03458

A few years go, Standard Radio Corporation shattered the HT size barrier with the C-108A and C-508A micro walkies. Being a lover of tiny gadgets, I bought a C-508A as soon as I could get my hands on one, vowing to let it go only if someone made a rig even smaller and/or with more power output.

Well, somebody has! Yaesu's new VX-1R is a full-featured dual-band (2 m and 440 MHz) HT which is about 25% smaller than the Standard rigs. It also puts out more RF—nearly twice as much—and has features galore. So I bought one.

Basics

This thing is really small. At about three by one-and-three-quarters by one inch (not counting the knob and antenna), it looks like a toy mock-up of an HT. It doesn't feel like a toy, though! Even though it only weighs approximately five ounces (with battery and antenna!), the case has a rock-solid, rugged quality. The fit and finish are immaculate. It's a real radio, all right.

The LCD is quite large and, in addition to the usual frequency and operating parameters, it displays alphanumeric labels for memory channels. There are seven backlit buttons on the front, along with the LCD and speaker and microphone holes. The left side has the usual rubberized PTT, monitor, and power buttons, plus the DC input jack, which accepts voltages of up to seven volts. On top is the dial knob, the SMA antenna jack (the rig is way too small to accommodate a BNC jack), and a single proprietary jack which handles external mike and speaker functions (yes, they make an adapter cord). The back of the rig is sculpted and holds the belt clip. Unlike on many modern HTs, the back isn't made of metal, and it doesn't serve as a heat sink. The battery, a high-tech 3.6-volt, 700-mAh, lithium-ion unit, fits inside the radio. The dual-band rubber ducky antenna is longer than the rig itself, but still much smaller than those provided with bigger radios. The ducky is stiff and seems pretty rugged.

The rig comes complete with the antenna, belt clip, wrist strap, battery, and AC adapter. The adapter is bigger than the HT! Also included is a well-written manual and a full schematic.

Features

Yikes, where to begin? The transmitter puts out one-half watt when using the lithium-ion battery, and one watt when using an external six-volt power source such as the included AC adapter or the optional car adapter. That's considerably more than the Standard, which provides 280 mW. That half watt reaches plenty of repeaters, at least here in Los Angeles.

This thing covers more bands than I've ever seen in an HT. For starters, it receives AM broadcast stations! It also covers the FM broadcast band, aircraft, two meters, VHF High public service, TV channels 7–13, the 220 ham band, UHF TV, 440 MHz ham, and the 800 MHz band (cellular blocked, of course). Essentially, coverage is continuous from 76 MHz to 999 MHz, except for cell. Narrow FM, wide FM and AM detection are available on a menu, plus the rig's automatic detector mode selection can be disabled, which is nice for exploring bands with multiple services using different modes.

CTCSS encode and decode are included, as is DCS (digital-coded squelch). In CTCSS mode, the rig can scan incoming audio for the correct subtone. The DCS system is much simpler than some others I've seen, and actually looks useful, at least for hamfests. Gone is all that confusing group code stuff; there's just a select-

able series of three-digit codes. Pick one, put a friend's rig on the same code, and you're all set.

As with other small HTs, there's no DTMF pad, so it's safe to assume the rig can't use the autopatch, right? Wrong! This one has eight DTMF memories, each capable of holding 15 numbers. In addition, you can send numbers manually, one by one, and the procedure is pretty easy, whether you're sending tones from memory or one tone at a time.

There are three new features I've never seen on an HT before. One, an emergency tone generator and transmitter, is designed to let you signal a listener if you're attacked while walking around. It also makes a loud (OK, relatively loud) noise from the radio's speaker. In essence, it's a personal alarm that can also send the alarm over the air. Frankly, it seems like a gimmick, although I can imagine ham families might use it to keep tabs on the safety of their kids (who must also be licensed hams, of course).

In a similar vein, there's a new Automatic Range Transponding System. This one requires that two radios have the same feature. It makes the rigs poll each other every fifteen seconds, warning when they get out of range. Sounds like a battery killer to me! On the other hand, it could be useful at hamfests or out in the wilderness.

The third new idea is great. Called "Smart Search," it's available on scanners, but I've never seen a ham HT incorporate it. It scans a range of frequencies and automatically stores active frequencies in a special set of memories. This is a very, very handy thing for the traveling ham, and I intend to give it a real workout on my upcoming trip to New England.

The battery

The battery in this radio deserves special mention. Following the lead of camcorder manufacturers, Yaesu chose to use a newfangled, high-capacity lithium-ion pack which pops inside the rig from the bottom. It looks kind of like an AA cell on steroids, and it provides 3.6 V at a whopping 700 mAh while weighing only about an ounce! This battery lasts a long, long time. The manual lists typical battery life as 12–14 hours, based on a cycle of six seconds of TX, six seconds of RX, and 48 seconds squelched.

The best part is that you can charge it whenever you like. Gone are the warnings about battery memory and full discharge before charging. Used the rig a few hours today, but want to charge it up all the way for tomorrow? No problem! And, it only takes two hours to go from dead to a full charge!

Great as they are, lithium cells require special charging methods. Consequently, the battery can only be charged inside the radio, and only when the power switch is turned off. So, you can't use the rig at all while charging the pack. Oh well, at least the charging happens fast.

Of course, you can have more than one battery, and just pop in the next one when the first one dies, saving charging operations for later on. Another solution is the optional FBA-20 battery case, which holds one AA cell. Yes, one! It allows just 100 mW of transmit power, and the cell gets chewed up fast, but it'll see you through the end of a hamfest or other local event when the lithium cell is exhausted. How the heck do they run the radio on 1.5 V? They don't: A DC–DC converter in the rig doubles the voltage to about 3 V. Clever, huh?

Memory organization

Although the ad literature claims 290 memories, that is, shall we say, a tad hyperbolic. There are two ways to configure the unit's memories. In Group 1 mode, there are 52 memories, each of which can store all the necessary ham data, including CTCSS frequencies and split RX/TX. In Group 2 mode, these are replaced by 142 "simplex" memories which can store repeater shifts, but not CTCSS frequencies. There are also 10 separate memories for the AM broadcast band, and there are 31 special memories which store the results of a Smart Search operation. Finally, there are 20 memories dedicated to 10 pairs of scan limits.

So, if you use Group 2 mode, you have 203 memories, according to my

addition. Thus, I'm not sure where the 290 figure comes from. It doesn't matter, though, since virtually all hams will wind up using Group 1 mode, which is the default. For practical purposes, you can consider the rig to have 52 normal memories, plus 10 pairs of scan limits. It's plenty.

Like most of Yaesu's newer radios, this one lets you assign a six-character alphanumeric label to each memory. In other words, you can name them. Until you've tried this feature, you can't imagine how useful it is! Especially if you travel often and keep repeaters for different cities in memory, it's great to just see "Boston" or "Hllywd" instead of a frequency whose location you may not remember. If you want to check that frequency, though, it's easy to do.

Segregation

The rig's most unusual memory feature is its segregation by band. Let's say you store some two-meter repeater frequencies in memories 1, 4, and 5, and some 440-MHz frequencies in memories 2, 3, and 6. In order to access the two-meter memories, you must first go to the two-meter band, by way of the Band button. Then, you'll see them. You *won't* see the memories which are storing the 440-MHz frequencies, or those from any other band; they appear to be nonexistent!

Photo A. *Yaesu's VX-1R combines remarkable (lack of) size with puzzling limitations.*

That deliberate design limitation has many ramifications. First, it means you can't scan memories containing different bands at the same time. So, if you want to listen for local calls, some of which are on two meters and some of which are on 440, you're out of luck; it's one band or the other at a time. That severely limits the usefulness of the VX-1R as a scanner, a purpose for which it otherwise would have been great. On my Standard, I can freely mix memories, and the rig transparently changes to whichever band is contained in the memory data as it scans. After all, if I want to scan my local repeaters for calls, do I care on which band they reside?

Second, it's impossible to set up crossband memories. There's no way to use the radio as a remote mike for your dual-band mobile while you're in the mall by setting up for transmit on one band and receive on the other. That, unfortunately, is a desirable use for small, low-powered radios like this one. I used to set my C-508A up crossband, using my base rig as its repeater, back when I lived in the country and couldn't hit any repeaters directly from an HT. It was great being able to walk around the property and get into distant repeaters via the base rig.

Finally, and most seriously, the inability to view memory contents without first going to the correct band makes memory entry awkward. When you go to store the VFO settings into memory, the rig lets you choose any memory number you want. If the memory is currently occupied, the memory number blinks. That's great, as it helps you avoid overwriting important memories. However, if you *do* wish to overwrite a memory, the first thing you're most likely to want to do is go check what you may be overwriting! Hmmm, which band is it on? You *can't see* what's in the memory unless you already know what band it's on! So, you wind up stepping through the bands, going through the memories, one by one, until you figure out which band has the memory you want to check. Remember, we're talking eight bands here! It's insanely cumbersome.

Compounding the situation is the lack of ability to use the top-mounted knob to zip through memories. You must use the front-mounted buttons. If you hold them, though, they start the rig scanning, so you have to press them over and over again to find your desired memory channel. You may wind up pressing those buttons dozens of times before you find what you're looking for.

This serious limitation is entirely software-based. It wouldn't have cost one extra penny to make the rig able to access any memory at any time, like the Standard can. I can't imagine why Yaesu designed the radio this way.

Radio performance

While I don't have access to a service monitor, I think it's safe to say the radio meets its published specs. I can, however, offer my observations on real-world operating, and some comparisons to the Standard, which is the only other dual-bander in this size class.

The VX-1R's transmitter gets out well. The half watt goes noticeably farther than the Standard's 280 mW. Part of that is also due to the antenna, which is a bit longer than the Standard's. The transmit audio is clean and clear. Nice transmitter, no complaints.

The receiver is not bad, but it doesn't compare with the Standard's RX. In the ham bands, the sensitivity seems quite good, but even nearly full-scale signals which are clean on the Standard have lots of hiss on them on the VX-1R. You need a really strong signal for noise-free reception. Also, local signals from a computer, which don't much bother the Standard, sometimes trash the VX-1R's reception. In its favor, the Yaesu's selectivity is nice and narrow; you can really tell when you're tuned 5 kHz off.

Out of band, the sensitivity varies from quite decent in the high UHF range to awful in the high VHF range. The local NOAA weather station on

162.55 is full-scale and full-quieting on my FT-530, weak but listenable on the Standard, and barely audible on the VX-1R. Part of that is the antenna; putting the FT-530's much bigger rubber ducky on the VX-1R (using a BNC-to-SMA adapter) raises the NOAA signal level to about 1/3 scale and hissy sound quality. It's better, but it still doesn't compare with either of the other two radios' performance.

The audio amp is pretty robust, but the speaker is small and tinny, as one would expect from such a tiny rig. It puts out plenty of high frequencies, which really exacerbates the hiss problem. There's an easy fix, though, using my old "kaboom audio enhancer" trick. Simply cover over all but the top two rows of speaker holes with some thick tape (being careful not to cover the mike hole in the upper right corner of the grille). I like to use the write-protect tabs from the old five-and-a-quarter-inch computer floppies. This forms a baffle which cuts the highs down quite a bit and strengthens the lower frequencies, dramatically improving the sound without making it noticeably softer. After the mod, there's plenty of audio and it sounds pretty good.

Super coverage

As I mentioned, the VX-1R covers darned near everything! It's great when you're traveling. If you're sitting in the airport looking for something to do, and two meters and 440 aren't hopping, you can listen to the news on FM or AM. TV audio from channels 7–13 and the UHF TV band are there, too, and you can even listen to the 220 MHz ham band! Or, you can check out the airport tower to hear when your flight arrives—not, of course, while you're flying!

The AM band

The AM broadcast band is handled differently from all the other bands. There are 10 dedicated AM-band memories. On this band, the display does not show the tuned frequency! All you get is a series of bars across the screen, and the S-meter bar graph moves to the right as you tune across the band. You have no idea at all where you are. Once you find a station and put it in memory, though, you can use the alpha label function to name it; the name, of course, can be its call letters or its frequency, if you can determine what that is (perhaps from a station announcement or by using another radio). AM reception using the rubber ducky is so weak it's barely usable, and there's no loopstick in the rig. In all fairness, where would they put one? If you hold the radio near some metal, or it's plugged into the AC adapter (which provides a nice grounding effect), you can hear a few stations. It certainly won't replace a $10 pocket radio, but who really needs an HT to receive AM anyway?

Documentation

The booklet is generally excellent, and covers everything from expected battery life to use of each menu item. I found no errors, and the grammar is good, too. It's easy to read. The only omission is in regard to memory backup; there's no mention of whether the rig uses a backup battery or whether memories will eventually disappear with no power applied. I assume nonvolatile memory is used, but I have no way to know.

As I mentioned, the schematic is large and very readable. I can't imagine how any user could try to repair a radio of this size, but it's still nice to have the diagram.

Given the complexity of this rig, a wallet-sized "cheat sheet" would

have been very welcome. Yaesu usually provides one with their rigs, and should consider adding one for the VX-1R.

The good stuff

You just can't beat the portability of this radio! It's small enough to take anywhere, and it has enough transmit power to reach at least a few repeaters anyplace you might be, unless, perhaps, you're way out in the country. The out-of-band coverage is truly remarkable, and having 220 MHz reception is great. The alpha naming of memories is something you won't want to live without once you've tried it. The lithium-ion battery is quite an improvement over NiCds, and the single AA-cell operation (with the optional battery holder) really extends the usefulness of the radio. Having DTMF available in such a tiny HT is a real treat. The AM detector is excellent, providing very good fidelity for aircraft or BCB listening. It's the best one I've ever heard on a ham HT. And you can read the battery voltage at any time, even while transmitting. It's a function on the menu, and you can call it up with one button press if you leave the menu set at "Battery.

The not-so-good stuff

I've owned lots of Yaesu handhelds, from the venerable FT-208R up through the FT-530. I've always considered Yaesu to be at the forefront of HT technology, especially where the user interface was concerned. The command sequences were intuitive and the firmware worked great.

This radio, alas, is an exception. The menu system is similar to the Standard's, and is the only sensible way to control dozens of functions from so few buttons. In this one, though, there appears to be no logic behind the grouping of the functions. For instance, the repeater offset and direction are next to each other, as they should be, but are nowhere near the CTCSS frequency and status, so entering a new repeater may require your stepping through a bunch of unrelated functions, unless you always use the automatic repeater offset function to avoid having to leave the CTCSS section of the menu. Plus, some of the command sequences make sense, while others are so counter-intuitive that I can't remember them. I've had to refer to the manual more with this radio than with any other I've owned. The Standard has a much simpler interface, and I learned that rig in no time.

Also, there are some significant bugs in the VX-1R's operating system. I'd be remiss if I didn't mention some of the bigger ones here:

The most serious bug occurs when you try to change the contents of a "home" memory channel (every band has its own) before storing any other memories on that band. Instead of changing it, the rig steals a home channel from *another* band! You wind up with two home channels on one band, and the loss of one on another band. If you try to delete the new (false) home channel, it just won't go away. It's happened to me several times. The first time, I spent about an hour trying to undo the mess. I finally found the cure: First, make sure the rig isn't displaying the false channel. Then, go back to the band from which it was stolen (you have to hunt around to find out which one) and try storing a frequency in its home channel again. The home channel will be stolen back and all will be well.

In the automatic squelch mode, which sets the squelch to the optimum point for most sensitive reception, scanning doesn't work properly. After the first time the rig pauses on a signal, the squelch doesn't close completely. The audio amp stays on, and the scan keeps pausing on each frequency through which it steps, regardless of whether or not there's a signal there. To reset the squelch, you have to either turn the rig off and back on, or change bands. Changing the squelch to a manual setting cures the bug.

Similarly, the emergency function doesn't turn off properly, either. Again, you have to turn the radio off and back on to get things back to normal. Oh, well, if you actually have to *use* that function, resetting your radio will be the last thing on your mind anyway!

The AM band's memories refuse to delete! Once you've stored an AM memory, you're stuck with it forever. You can change its contents, of course, but it's there to stay. Also, the detector mode setting reads "FM-N" (for "narrow"), not AM, and you can't change it. The good quality of the audio, however, makes it obvious that the detection is actually AM. (On other bands, the mode detection shown is correct.)

Conclusion

Despite some real shortcomings, the VX-1R is the *bee's knees!* The size alone makes it worth having for hamfests and travel. The rig needs a firmware overhaul, and I hope Yaesu will consider fixing the bugs and removing the memory segregation. With such corrections, this $300-class micro HT would be truly great, both as a ham rig and a scanner. As it is, it's still cool, and I'm keeping mine!

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the September issue, we should receive it by June 30. Provide a clear, concise summary of the essential details about your Special Event.

JUNE 6

BANGOR, ME The Pine State ARC will sponsor the Bangor Hamfest 08:00–13:00 at Hermon High School. Take I-95 to Exit 44 (Cold Brook Rd.), north to US #2. Take US #2 one mile to the high school. From the village, take US #2 east one-half mile to the high school. Admission $3.00; under 12 free. There will be VE exams for all classes; tailgaters; dealers; demonstrations; old keys; old radios; a working station; ARRL and section forums; and more. Campgrounds and many motels within five miles. The event will be held rain or shine. For more info, contact *Roger W. Dole KA1TKS, RR #2 Box 730, Bangor ME 04401. Tel. (207) 848-3846.*

CHARLOTTE, NC The 6th annual Charlotte ARC Hamfest and Computer Fair will be held Saturday, June 6th, at the Roll-A-Round Skating Center at 8830 East Harris Blvd. in Charlotte, 7:30 a.m.–12:30 p.m. There will be computer and radio dealers, as well as flea market tables and tailgating. Doors open for flea market unloading at 6 a.m. Admission is $5 at the door; children 12 and under admitted free. Tailgating requires an admission ticket plus $5 per parking space. Flea market tables (8' x 2') are $10 each; chairs are $2 each. Tables and chairs must be reserved in advance, as extra tables will be very limited the day of the show. Send pre-registration requests, with an SASE, to *Charlotte ARC, P.O. Box 33582, Charlotte NC 28233-3582.* Pre-registrations without SASE, or received after May 24th, will be held at the door. No one except children will be admitted into the indoor flea market area *or* tailgating area without a ticket. The selling or solicitation of pornographic-type material is prohibited within the indoor or tailgating areas. For more info, send Internet E-mail to [w4cq@qsl.net]; or visit the home page at [http://www.qsl.net/w4cq/]. Talk-in is on the 147.06(-600) repeater. Radios which automatically program the offset will normally use +600, so please check this carefully.

TEANECK, NJ The Bergen ARA will hold its annual Fall Hamfest at Fairleigh Dickinson University. Buyer admission is $5, with XYLs and harmonics free. Seller admission $10. VE exams. Take Route 4 east/west to the River Rd. exit. Follow the signs into the hamfest area. Talk-in on 146.790 (-600). Contact *Jim Joyce K2ZO at (201) 664-6725 before 10 p.m.*

JUNE 7

BUTLER, PA The 44th Breezeshooters' Hamfest will be held Sunday, June 7th, 8 a.m.–4 p.m. on the Butler Farm Showgrounds, just north of Butler. Handicapped accessible. Admission $5 per person, under 12 admitted free. Take PA Rt. 68 east from Interstate 79, or take US Rt. 68 west from PA Rt. 8. Talk-in on 147.96/.36. Tailgaters' spaces $5 each. Indoor vending tables $15 per table, rented in advance, first come, first served. Reservation deadline is May 15th. Send payment with an SASE to *George Artnak N3FXW, 3350 Appel Rd., Bethel Park PA 15102,* or call the *Breezeshooters' Hotline at (412) 854-5593;* or use E-mail to *[geoart@usa.net].* Check out the Breezeshooters' Web site at *[http://www.users.sgi.net/~wolfie/].*

JUNCTION CITY, WI The Central Wisconsin Radio Amateurs, Ltd. (CWRA), cordially invites your participation at their 21st annual Swapfest and Auction, Sunday, June 7th, at the US Army Reserve Center. This is a new location and offers Saturday evening setup and overnight security, as well as inside-the-building loading and unloading. Tables are $4 each if requested prior to May 15th. After May 15th, tables will be $7 plus admission. Admission tickets will be $3, and free for children under 12. Doors open to the public at 8 a.m. (6:30 a.m. to vendors choosing Sunday morning setup), with shutdown by 1:30 p.m. We are encouraging tailgaters to sell their unsold goods at our auction at noon. Talk-in on 146.670 WB9QFW and 146.985 W9NN repeaters. Contact *John Feltz W9JN, CWRA Swapfest Chairman, 973 East First St., Junction City WI 54443-9614. Tel. (715) 457-2506; E-mail [jfw9jn@tznet.com].*

MEDINA, OH Join the M2M Group for the 1998 Medina County Hamfest, Sunday, June 7th, at the Medina County Fairgrounds Community Center, 735 Lafayette Rd., Medina OH. Vendor setup at 6:30 a.m. Open to the public 8 a.m.–3 p.m. General admission $5; $4 in advance. Inside vendors' tables $10; $9 in advance. Flea market spaces $8; $7 in advance. Reservation deadline is May 23rd. Enclose an SASE for return of tickets. Send advance payments to *Medina Hamfest Committee, P.O. Box 452, Medina OH 44258.* Please call *(330) 725-0119* for info about VE exams; walk-ins welcome. Mobile check-in on 147.630/.030.

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds in Princeton IL. Doors open at 6 a.m. Advance tickets are $5 with 4 stubs before May 20th, and $6 with a single stub at the gate. Camping and outdoor flea market area is free. 8' tables indoors are $10 each. Talk-in is on 146.355/.955 PL 103.5. Contact *Bruce Burton KU9A or Debbie Burton N9DRU, 1153 Union St., Marseilles IL 61341-1710. Phone (815) 795-2201; E-mail [brburton@mtco.com].*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the NY Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendor setup at 7:30 a.m. Buyers admitted at 9 a.m. Free parking. Buyers $5, sellers $10 per space. Talk-in on 444.200 rptr., PL 136.5. Contact at night only: *Stephen Greenbaum WB2KDG, (718) 898-5599;* or E-mail *[WB2KDG@bigfoot.com].*

JUNE 13

DENNIS, MA The Cape Cod Tailgate Swapfest will be presented by the Barnstable ARC 8 a.m.–3 p.m. Setup is at 7 a.m. Take Exit 9 off the Mid-Cape Hwy. (Route 6), head south on Route 134, 0.3 mile to Theophilus Smith Rd. on the left. VE exams. Admission $2.50 at 9 a.m. Early birds $10 at 8 a.m. Sellers $5 per space. Talk-in on 147.045 repeater. Contact *Don Haaker WA1AIC, at (508) 760-1571.* Rain date is June 20th.

FERGUS, ONTARIO, CANADA The 24th Central Ontario Amateur Radio Fleamarket will be held at the Fergus and District Community Center (just a few miles north of Guelph on Hwy. 6), beginning at 8 a.m. Setup at 6 a.m. Snack bar and rest rooms open at 6:30 a.m. General admission $5, under 12 free. Tailgating $5 per space; indoor tables $10 per 8' space. On-site fully serviced campground lots available at $13.75 per night. Talk-in on VE3ZMG at 145.21; VR3KSR at 146.97; or simplex 146.52. Make all checks payable to *Central Ontario Amateur Radio Fleamarket* and mail with SASE to *Bill Smith VE3WHS, 32 McElderry Rd., Guelph Ontario N1G 4K6, Canada. Tel. (519) 821-6642. E-mail [fleamarket@kwarc.org];* or check the Web site at *[www.kwarc.org/fleamarket].*

PADUCAH, KY The Paducah ARA Hamfest will be held Saturday, June 13th at the Executive Inn Convention Center in downtown Paducah, 8 a.m.–3 p.m. VE exams at 1 p.m. Plenty of free parking. Admission $5, tables $6 each, with one free ticket per vendor. Write to *The Paducah Amateur Radio Assn., P.O. Box 1022, Paducah KY 42002-1022; or E-mail [KC4ENA@Apex.Net].*

JUNE 14

BETHPAGE, NY The Long Island Mobile ARC will host their Long Island Hamfair, 9 a.m.–2 p.m. at Briarcliffe College, 1055 Stewart

Ave., in Bethpage. Amateur radio equip., computers, ARRL and LIMARC info, VHF tune-up clinic, and more. Talk-in on W2VL 146.85 rptr. VE exams for all classes. General admission $6, children and sweethearts free. Vendors: all spaces $15, each space admits one person. Free parking for buyers. For more info, call the *LIMARC 24-hour infoline at (516) 520-9311* or check the Web page at *[http://www.limarc.org]*.

ERLANGER, KY The Northern Kentucky ARC, Inc. (of Covington KY), will host their "Ham-O-Rama '98" June 14th, 8 a.m–3 p.m. at the Erlanger Lions' Park. Take I-75 to Exit 184 (Route 236 East). Go one mile and turn right on Dixie Hwy. (US Routes 25 & 42). Go one mile to Sunset Avenue, turn right and go to the end of Sunset Ave. For more info or advance registration, contact *Robert Blocher N8JMV c/o NKARC, P.O. Box 1062, Covington KY 41012. Call evenings at (513) 797-7252.* Or call *Neal KC4FET, (606) 341-1213; or Ken KZ5KR, (606) 384-4002.* Indoor exhibit area for major vendors. Extensive outside flea market with setup at 6 a.m. Tickets $4 in advance, $5 at the gate; children under 13 admitted free. Flea market spaces $2 each (bring your own table and chair). Indoor vendor space $15 per table (provided). Registration deadline is June 1st. Send remittance with an SASE. Talk-in on 147.255(+) or 147.375(+) K4CO rptr.

GRANITE CITY, IL The Egyptian Radio Club annual Egyptian Fest—Hamfest, Computer Fair and Flea Market—will be held at the Granite City Campus of Belleville Area College, one-half mile south of I-270 on Illinois Route 203 S, 8 a.m.–1 p.m. Indoor dealer and exhibitor area. Talk-in on 146.79. Admission $3, tables $12. Tailgating, no additional charge. Contact *Egyptian Radio Club, P.O. Box 562, Granite City IL 62040,* or call *Bill Dusenbery N9OQK, (618) 398-1456.*

SUFFIELD, OH The Goodyear ARC of Akron OH, with the assistance of The Pioneer Amateur Radio Fellowship and The Silvercreek ARA, will hold its 31st annual hamfest, 8 a.m.–4 p.m., Sunday, June 14th, at Wingfoot Lake Park, near Suffield OH, 10 miles east of Akron OH. Entrance is from State Route 43, one mile south of 224. Admission is $4 ($3 before May 20th). One ticket admits ham, spouse and children. Make checks payable to *The Goodyear ARC* and mail with an SASE to *Ken Phillips K8CHE, 351 Hillman Rd., Akron OH 44312-2131. Tel. (330) 733-5795; E-mail [aa635@acorn.net].* VE exams at 10 a.m.—ask at the gate for the location. Walk-ins only. Bring license and copy, and photo ID. Flea market spaces $5 each. Park rules: No pets, no guns, no pornographic materials.

WHEATON, IL The Six Meter Club of Chicago, Inc., will hold its 41st Annual ARRL-sponsored hamfest at the DuPage County Fairgrounds, 2015 Manchester Rd., north of Roosevelt Rd. (Rte. 38), east of County Farm Rd., Wheaton. Free parking. No extra charge for space in the outdoor flea market. Limited overnight RV parking with elec., $10; advance reg. required. Sellers only at the east gate. General parking at the west gate. Gates open at 7 a.m. Indoor setup for pre-registrants at 7 a.m. Buildings open to the public at 8 a.m. VE exams 9 a.m.–noon; call the *24-hour info line at (708) 442-4961* to pre-register for testing. Advance tickets are available from *Joseph Gutwein WA9RIJ, 7109 Blackburn Ave., Downers Grove IL 60516-3925,* or any club member. Commercial tables, 8 ft. w/110V, main bldg., air cond., $15 ea. Indoor flea market tables, 8 ft., no elec., $10 ea. Advance tickets for everyone over age 12, $5 ea. Send checks payable to *Six Meter Club of Chicago,* and SASE to *Six Meter Club of Chicago, at the address above,* no later than May 30th.

JUNE 19–21

RED DEER, ALBERTA, CANADA The Central Alberta Radio League will host its 28th annual Picnic and Hamfest at the Burbank Campsite located approx. eight km NE of Red Deer. Talk-in on 147.150 (+600) or 146.520 simplex. For info contact *Bob VE6BLD, 5540 54th Ave., Lacombe, Alberta, Canada T4L 1L6.* Phone evenings, *(403) 782-3438. Packet VE6BLD @ VE6RDR.AB.CA; E-mail [kingel @telusplanet.net].* The club home page is *[http://qsl.net/carl/]; E-mail is [carl@qsl.net].*

JUNE 20

BLUEFIELD, WV The Bluefield Hamfest will be on Saturday, June 20th, 8 a.m.–2 p.m. at the Brushfork Armory on US 52, one mile north of Bluefield WV. VE exams on site at 9 a.m.; walk-ins accepted. Hamfest admission $5, children under 12 free. Table rentals $5 each. Inside flea market and dealers. Handicapped access. This is western Virginia and southern West Virginia's oldest hamfest (41 years). Talk-in on 145.49 (BR549) repeater. For additional info, send SASE to *Bluefield Hamfest, Inc., 412 Ridgeway Dr., Bluefield VA 24605-1630;* or *E-mail [wa4k @sera.org].* Dealers contact *Bob Frazier WB8NRK at (304) 425-8465; or E-mail [cna00188@ mail.wvnet.edu]. Internet address: [http://www. inetone.net/erarc/ hamfest/].*

MIDLAND, MI The 22nd annual hamfest of the Midland ARC will be held at the Midland County Fairgrounds. The show features amateur electronics and equip. (both new and used), VE exams, and more. Doors open to the public 8 a.m.–1 p.m. Admission $4, advance reserved tables $6 ea., trunk sale space $5. Talk-in on 147.00(+). For more info contact *M.A.R.C. Hamfest, P.O. Box 1049, Midland MI 48641.* Please SASE. Or call *Jeff Weinberg at (517) 636-0643 (w); (517) 839-9371 (h), or E-mail [w8cq@bytethis.com].*

JUNE 21

CAMBRIDGE, MA Tailgate electronics, computer and amateur flea market, June 21st, 9 a.m.–2 p.m. Albany and Main Sts., Cambridge MA. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Sellers $10 per space at the gate, $9 in advance; includes one admission, setup at 7 a.m. For space reservations or further info, call *(617) 253-3776.* Mail advance reservations before June 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/ 444.725 PL 2A W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

CROWN POINT, IN The annual "Dad's Day" Hamfest, sponsored by the Lake County ARC (of Merrillville IN) will be on June 21st at the Lake County Fairgrounds in Crown Point. Talk-in on 147.00, 146.52, and 442.075. There will be computers, and software and hardware vendors. Setup begins at 6 a.m. Doors open to the public at 8 a.m. Admission $5 per person, tables $6 each. Contact *Malcolm Lunsford W9MAL, 6721 Harrison Ct., Merrillville IN 46410-3323. Tel. (219) 769-3925; or E-mail [w9mal@cris.com].*

MONROE, MI The Monroe County Radio Communications Assn. will hold its annual "Monroe Hamfest" from 7:30 a.m.–1 p.m. at the Monroe County Fairgrounds, 2 miles west of Monroe on M-50. 8-ft. indoor tables $10; trunk sales $5 per 8-ft. space. Overnight camping $15, free parking. Advance tickets $4, $5 at the door. Contact *Fred VanDaele KA8EBI, 4 Carl Dr., Monroe MI 48162. Tel. (313) 242-9487 after 5 p.m.* Talk-in on 146.72.

JULY 11

SALISBURY, NC The North Carolina Alligators Group will hold their Firecracker Hamfest July 11th, 8 a.m.–1 p.m. at the Salisbury Civic Center. From Interstate #85, West/East Innes St., turn left on South Boundary St. and the 'fest is on the left. Advance admission is $3 with an SASE, or $4 at the door. Always free to XYLs. The price of admission allows you to set up outside for the flea market. Tables in the air-conditioned center are $5. Dealers can set up on from Friday 3 p.m.–9 p.m. and check into the center at 7 a.m. on Saturday. There will be an auction of goods at 1 p.m. VE exams by TEARC/VEC on site at 10 a.m., walk-in only, no pre-registration. Applicants must bring original license, photo-copy of present license, any CSCEs and a photo ID to the exam session. For further details, contact *Rae Everhart K4SWN, P.O. Box 41, Lexington NC 27293-0041. E-mail [RAEF@ infoave.net].* Talk-in on 146.520 simplex. For hamfest info, contact *Walter (Alligator) Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071. Tel. (704) 279-3391.*

JUL 26

HONOLULU, HI In celebration of their third wedding anniversary, a grand Ham-Boree is being planned by Gordon Crowhurst G4ZPY and Brenda in the form of a big get-together of hams and their partners for an evening meal in Honolulu. They would like to put a face to a callsign, a face to a name, of their many friends and acquaintances all over the world. For those who are interested, there are a lot of nearby mountains for DXing on the Pacific Rim. For more info contact *G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough, Ormskirk, L40 7TG England. Tel./FAX (44) (0)1704-894299* anytime until 2300, but not between the hours of 1600–1830 local time. Everyone must make their own holiday arrangements themselves and pay for their evening meal. Please R.S.V.P. so that a suitable location may be arranged for the get-together.

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

SPECIAL EVENT STATIONS

JUNE 6–7

BOWLING GREEN, KY The Western Kentucky DX Assn. will operate KB4ALC from 0001 UTC June 6th–2359 UTC June 7th, in celebration of the annual Corvette Homecoming in Bowling Green. Frequencies: 7280, 14280, 21380, and 28480. Stations contacted may request a certificate by sending a QSL to *Kenneth E. Newman KB4ALC, 505 Emmett Dr., Bowling Green KY 42101 USA.*

JUNE 20–21

ALBUQUERQUE, NM Special event station W5P will be on the air 1600–2400 UTC Sat. and Sun., using 2–40 meters QRO and QRP in the Novice, Tech, and General portions of the bands. Modes: CW, SSB, RTTY, and FM. Grid square DM65. QSL with a #10 SASE to *W5P, Jay Miller WA5WHN, P.O. Box 6552, Albuquerque NM 87197-6552, USA. E-mail [wa5whn @rt66.com]* for more info about this special event station, or view *[http://www.swcp.com/~n5zgt/].* Click on the W5P icon. A celebration of the NM Star Party will be held in Rio Rancho NM on June 25th, and the public is invited to attend.

JULY 1–5

OSHKOSH, WI Radio Amateurs of Wisconsin, in conjunction with the Wisconsin Sesquicentennial celebration and the 27th annual Sawdust Days Festival, will operate W9W 1700–0200 UTC, in the General portions of 10, 15, 20, and 40 meters, SSB and CW. Send a 9 x 12 SASE for the certificate to *Mark Miller N9WT, 336 W. 8th Ave., Oshkosh WI 54901-5928 USA.*

JULY 11

BETHEL, CT Rare VHF grid square FN40 will be activated to coincide with the July 1998 CQ VHF contest weekend. The Candlewood ARA in Danbury CT will set sail for grid FN40, located just off the eastern tip of Long Island NY, on July 11th, 1998. Operation will begin before the contest period at 1300 UTC, and conclude at 2359 UTC, Saturday only. Contest class will be multi-operator class 2. Packet cluster spots will be through YCCC and Tri-State networks. The club call, W1QI, will operate simultaneously on the 50, 144, 220, and 432 MHz bands, using SSB primarily, with some CW and FM. Output will range from 50 to 150 watts to single yagis mounted on one or two small boats (sorry ... the cruise ships were all booked!). Plans and operating details will be posted as they develop on the CARA Web page at *[http://www.danbury.org/org/cara/].*

JULY 11–12

KALAMAZOO, MI The Southwest Michigan Amateur Radio Team (SMART) will sponsor a special event station starting July 11th at 1800Z–0200Z July 12th. The station will be located in Kalamazoo MI and will operate under the new club call K8KZO. All contacts will be in the phone bands on or around 3.904, 7.2704, 14.304, 28.304, and 147.04. This event is to celebrate the 40th anniversary of SMART. To obtain a certificate confirming the contact, send a QSL and a 9" x 12" SASE to *SMART, P.O. Box 3175, Kalamazoo MI 49003-3175 USA.*

NEVER SAY DIE

continued from page 5

kits you've built. You *do* know how to write, don't you?

The FCC and Politics

Maybe you've read where the FCC has been hassling Yaesu over the way their FT-50R dual-band HT can be modified to receive cellular telephone channels.

For many years the FCC championed the concept that the radio waves were open to everyone. The FCC used to actively fight any attempts at restricting the reception of frequencies. The police hated this because crooks could legally monitor their police channels. The FCC was unmoved.

Then came the cellular telephone industry. The *multi-billion* dollar cellular telephone industry. Their customers, after using telephone all their lives with the innocent expectancy of privacy, tended to get upset when they found that their telephones were no longer private. Actually, the

Continued on page 80

A Hamfest Every Day

The fun never stops!

Bill Clarke W2BLC
764 Alta-Voor Road
Altamont NY 12009

One of the most enjoyable activities for hams is hamfests—those gatherings where hams get a chance to look for used and new equipment, parts, and radio paraphernalia. Looking at all the old rigs for sale, some at bargain prices and others at—well, you know—slightly more than the price of gold. But suppose you live in an area where there aren't a lot of hamfests, or you can't easily attend a hamfest because of work- or health-related problems. Then what do you do if you're looking for a used rig?

Where I live now, in upstate New York, the number of hamfests is considerably lower than I was used to in 4-land. In fact, unless I want to drive several hours, there is only one hamfest nearby each year. There are very good trader nets on the air and they're interesting to listen to, but unfortunately, listening to them takes a lot of time and they do operate on their own schedules.

So, what do you do when you are looking for a piece of equipment on a Thursday evening, say around 11:30 or any other time that is uniquely suited to *your* free time? I doubt if you'll find a hamfest to go to. Of course you could look in the various printed publications for used equipment listings. But the pages get worn quickly and the listings are a couple of months stale (due to the lead time required to publish a magazine). So *now* what?

Cybershop

There are advantages to doing my looking by computer. Time is never a factor; I can "hamfest" at two o'clock in the morning on a Tuesday if I want to. The weather is no bother, either. The stuff is always there. Of course you won't find very many old dusty boxes filled with broken switches, odd connectors, meters, and other junk listed on the computer. Generally, only rigs and large items such as tuners, amplifiers, microphones, keys, power supplies, and the like are listed.

Some ham-related equipment is listed on packet. You may have seen the listings by the subject or address of 4SALE, FORSALE, or SALE. Some of the items will be available locally or regionally. I have also seen equipment for sale from all over the country. Packet radio is good, but it is only one place to look.

"All over the country" brings up a point about hamfesting on the computer. Items are listed from all over the country and, sometimes, from all over the world. This could provide some interesting shipping problems—depending on what the item is, how big or heavy it is, and where it is.

Now, if you are on line and have access to the Internet, you are going to see more radios and other ham-related equipment for sale (FS) and wanted to buy (WTB) than you could if you went to several hamfests or spent all week listening to the trader nets. In this article I am going to give you the "addresses" for a number of ham radio swap Web sites. Some are semi-commercial, a couple are completely commercial, and most are just places to make listings for one and all to see—without cost.

I'll also give you the names of a few discussion groups that are great for browsing when looking for a specific piece of equipment, or wanting to sell something. In most instances, you will be able to look at listings of items for sale or wanted, and can also add items you wish to sell or buy.

Buying, selling, and not getting burned

The warnings about buying and selling over the Internet are pretty much the same as you would expect when buying, selling, or trading anything from any individual. The source of the information may be slightly different, but it matters very little whether you are reading printed classified ads, listening to a trader net, looking at a Web site, or watching a discussion group. You are dealing with an individual who is mostly likely unknown to you. Fraud happens.

Payment and shipping terms should be mutually acceptable between the buyer and the seller. Typically this will mean money up front, COD (cash or collect on delivery), or payment upon receipt and inspection. For COD or payment upon receipt and inspection you will have to make advanced arrangements with your shipper—and there will be additional fees and delays. The most prominent delay occurs in getting the funds into the hands of the seller. Before using COD, check to see if the shipper (United Parcel Service, FedEx, US Postal Service) will be holding the funds for several days or weeks.

There are a few safeguards you may take when purchasing from a stranger. The best is to buy from someone who is nearby, perhaps within driving distance. That way you can see the piece of equipment for yourself and may even get an opportunity operate it. If you have to deal long distance, ask for a reference. Some hams do a lot of trading and are well known, which can be good or bad. When thinking about spending a couple of thousand dollars for a used rig or amplifier, I am *very* careful!

Some sellers are afraid of bad checks and want to hang on to their equipment until the check clears. This is understandable. To avoid this problem, use a Postal Money Order or bank cashier's check. Or, if you are afraid the item will not be shipped, have it sent to you COD. If you are selling, you are faced with the same problems—only you are on the other end of the stick.

We all want to protect ourselves from being burnt during a transaction. Most of the hams you will ever deal with will be honest and upright, but there are a few bad apples around. In the end, it comes down to *buyer beware*—and *seller* beware, too! One last recommendation is to use the US Postal Service for handling the financial end of the transaction. Using the mail to send the check and a note of understanding affords you some protection from fraud and access to postal investigators should the need arise. A note of understanding is just an informal note that tells the seller your name and address, the amount of funds included, and what you understand is included in the purchase.

Ready for shipping

The two most common forms of shipping are: the US Postal Service with a 50-pound weight limit on packages and the United Parcel Service (UPS) with a 150-pound limit. Overnight shipping services are available from both the Postal Service and UPS, as well as other carriers, such as FedEx, but costs are high.

If you are shipping something really heavy, like a Henry console amplifier, you must ship via motor freight. That too will be costly. Sometimes equipment can be broken down into lighter or smaller packages, such as a separate box for a power supply.

Equipment to be shipped must be packaged properly and insured. Although it is a little more expensive, I recommend having a commercial shipper pack radio equipment, unless the original shipping boxes are available and in good shape.

Protecting the investment

No matter how you ship the equipment, or have it shipped to you, be sure to insure the items being shipped. Insurance provides accountability on the part of the shipping company and will help in the case of damage or loss while in transit.

Get the shipping or tracking number for the package(s), if possible, and you may be able to watch the progress of the shipment on the computer via a link with the shipper on the Internet. And, even with all this information, packages *do* get delayed or lost.

First contact

Your first contact with the seller of a piece of used equipment should include a simple rehash of what the gear is and the asking price. Then get into specifics about appearance, how well it is working, and why the owner is selling it. The last point is very important. Is the owner upgrading or getting rid of something that is marginal in operation or appearance? The seller may also be a part-time dealer having only a profit motive for sale. However, just because the seller is a dealer doesn't mean you won't get a fair deal. In fact, a dealer may be just the person you want to work with. Generally, your first contacts will be by E-mail—using the address provided in the listing.

Where to look

The following information includes the names and Internet addresses of many of the ham radio trading Web sites. The list is not meant to be exhaustive, as Web sites come and go.

The Ham Trader Home of the Radios & Electronics Classifieds is a feature-rich Web site operated by Island Link Solutions, Inc. It has a database searchable by category, make, or key word. Clickable E-mail addresses are usually included with telephone numbers. [www.hamtrader.com]

The Virtual Hamfest is a commercial Web site that charges a sales commission of 2% to the seller. Listings are in date order and some listings have pictures. The Web site can be set to E-mail new listings directly to you. Upcoming hamfests are also listed. Equipment is by category and listings have contact information—usually with a clickable E-mail address. [www.vhamfest.com]

Amateur Radio Classified Database, sponsored by Raymond Sarrio WB6SIV, can be accessed from his Web site's home page. It has a nice interface that allows the user to pick the category and make of interest—if desired. The

user can build a list for later viewing or may individually read each listing. Name, address, E-mail, and telephone numbers are given in the text of the listings for contact purposes. [www.sarrio.com]

QTH.COM Ham Radio's Classifieds, recently awarded the Best Cyber Ham Award, is Webmastered by Scott Neader KA9FOX. The database provides categorized listings with E-mail addresses for contact. [www.QTH.com/classifieds.shtml]

The Drake List Home Page, hosted by Thom LaCosta K3HRN, is a super Web site for the Drake enthusiast. The Web site supports classified listings, modification information, and much more. [www.min.net/%7Ethom/drakelist/index.html]

Contesting On-line RadioSwap is brought to you by Akorn Access, Inc., an Internet service provider and WWW host service located in the foothills of the North Georgia mountains in Alpharetta, GA. The system provides listing access by category, date, and/or caption. Names, callsigns, phone numbers and E-mail addresses are given for contact purposes. [205.217.100.14/RadioSwap/Search.HTM]

The RING! Ham Radio OnLine Trading Station, hosted by Ring! OnLine of White Lake, MI, provides accesses to its listings database by category. The Web site gives some excellent trading advice and the listings contain all the required contact information from name to E-mail. [www.Ring.com/trading/hamradio.htm]

The Ham Radio Trading Board is provided by CameraWeb of Malvern, PA. The Web site uses frames for selecting the items of interest. E-mail addresses are provided as a means of contacting the seller. [www.cameraweb.com/hr]

The ARRL Web site allows you to view the current *QST* ham ads from its home page. Appearance of the ads is similar to that seen in *QST*. Contact information is given, including some E-mail addresses. [www.arrl.org]

The Amateur Radio Swap List is a free service provided by KAC Website Design of Denver, CO. Listings are posted in date order, the most recent at the top of the list. Contact information includes city and state and clickable E-mail addresses. [www.kacweb.com/swaps/radio]

Ham Radio/Electronics Ads provides listings in date order with E-mail and telephone numbers for contact purposes. [www.westes.com/ads]

Amateur Radio Trader, published by Trade-A-Plane Publishing, in Crossville, TN, is an on-line version of their printed product. Listings are by category, with phone numbers. [www.amradiotrader.com]

I have not included the [http://] portion of Web site addresses, as most new browsers add that for you automatically. When entering the Web site addresses, be sure to type them exactly as given. Upper and lower case does sometimes make a difference.

Some Web sites are slow to load up. Sometimes this is partially due to the large amount of graphics carried on the Web site. Generally, the less fancy the site, the quicker it loads.

Where else to look?

In addition to Web sites, there are several discussion groups that have items for sale and wanted listed on them. Discussion groups are also excellent places to ask questions or seek advice from other group readers. Depending upon the specific browser you are using, you can set them up by list selection or direct entry. Discussion groups of interest for trading are:

[alt.ham-radio.marketplace]
[rec.radio.swap]
[rec.radio.amateur.equipment]

Additional discussion groups may be found by pointing your browser to [www.QTH.net] and making selections from there.

About boat anchors

Had an itch to own a piece of history? Perhaps you know how much better the audio is from a tube-type rig. Or maybe you want a rig you can maintain yourself, without loads of expensive test equipment. Of course tube radios are also known to warm hearts and hands on a cold winter's night. In any case, the discussion group [rec.radio.amateur.boatanchors] is a great place to look or list your wants.

You may also want to check *The Radio Finder*, an absolutely superb Web site run by Abe Thurtell KC8AHW for his father, Joel Thurtell K8PSV of Plymouth, MI. Joel is a dealer buying, trading, and selling tube-type amateur and military radio equipment. The Radio Finder Web site is my personal favorite and is loaded with many fine pictures—don't drool on the keyboard! [www.radiofinder.com]

Postscript

Well, all these electronic things ... you know, computers and modems, and the Internet, are really great, and you can find tons of stuff to buy out there, but I still like going to *real* hamfests. They are loads of fun, even when you come home with your stomach churning, either from the overdone chicken—or the rig you *just* missed!

By the way, there are other discussion groups and Web sites out there just waiting for you to find them. All you have to do is a little searching. 73

In Search of a Simple Phone Patch

But who needs one, anyway?

Robert B. Landon KD6ORG
6860 Eddinghill Drive
Rancho Palos Verdes CA 90275
[rlandon@flash.net]

How often do you need a phone patch? If you're like me, you would say "almost never" or "once in a while." However, for those times when a contact asks if you could do a local phone patch, it would be nice to say, "Sure ... no problem." Unfortunately, the classic phone patch is not simple. It consists of audio circuitry, VU meters, VOX (Voice Operated Switching), multiple transformers, line impedance simulators, and connections to your transceiver's microphone, audio output, power, and, of course, the telephone line. All this complexity adds up to cost, messy interfaces to your equipment, and general inconvenience (especially if you want to use it with more than one transceiver). Also, in the off chance you wanted to purchase a patch, just try to find one in the ham catalogs or magazines. Again, if you are like me, all of these reasons are why you do not already have one in your shack—what started me on my quest for a simple phone patch.

Some things you don't need

I searched the literature, built many experimental patches, and drove my ham friends crazy with requests to help me test them. After becoming familiar with the Plain Old Telephone System (POTS), balanced hybrid line transformers, IC op amps, VU meters, and various other interesting things, I finally concluded that there are a lot of nice but unneeded functions you can live without.

1) You don't need VOX. This decision eliminates fiddling with telephone line impedance simulators and hybrid transformers, setting delay timing, and the delicate adjustment of signal levels. Since you have to be there anyway to control the station, your hand on the transmit/receive switch can replace VOX.

2) You do not need an added electrical connection to your microphone. You need some sort of audio monitoring of the telephone so that you can control the transmit/receive switch. If you use a speaker to monitor the telephone, you can eliminate the electrical interface with your microphone by making sure it can hear the same thing that you are hearing. This eliminates a messy electromechanical interface in series with your microphone (and the problem of finding matching connectors).

3) In some cases, you don't need an added electrical connection into the phone line. Similar to the conclusion in #2 above, you may be able to use acoustical coupling into your phone ... read on.

4) You don't need a VU meter. The VU meter is normally used to set signal levels to meet telephone company standards. However, if you just adjust your input signal levels to be approximately equal to the levels received from the telephone, it works just fine. The use of acoustic monitoring of both inputs and outputs to the telephone is the key to this simplification.

What will the phone patch look like if we throw out all these typical functions?

By eliminating all the typical phone patch functions listed above, you can have a phone patch that does not require *any* modifications to your current rig. If this sounds too good to be true, you're right: There *is* one small hitch. This ultimate in phone patch simplification requires that you have a modern speakerphone adjacent to your rig. The new speakerphones are surprisingly good, with no evidence of the feedback or delays that plagued the earlier models. Both the Lucent Technologies 822 and the GE 2-9315 have

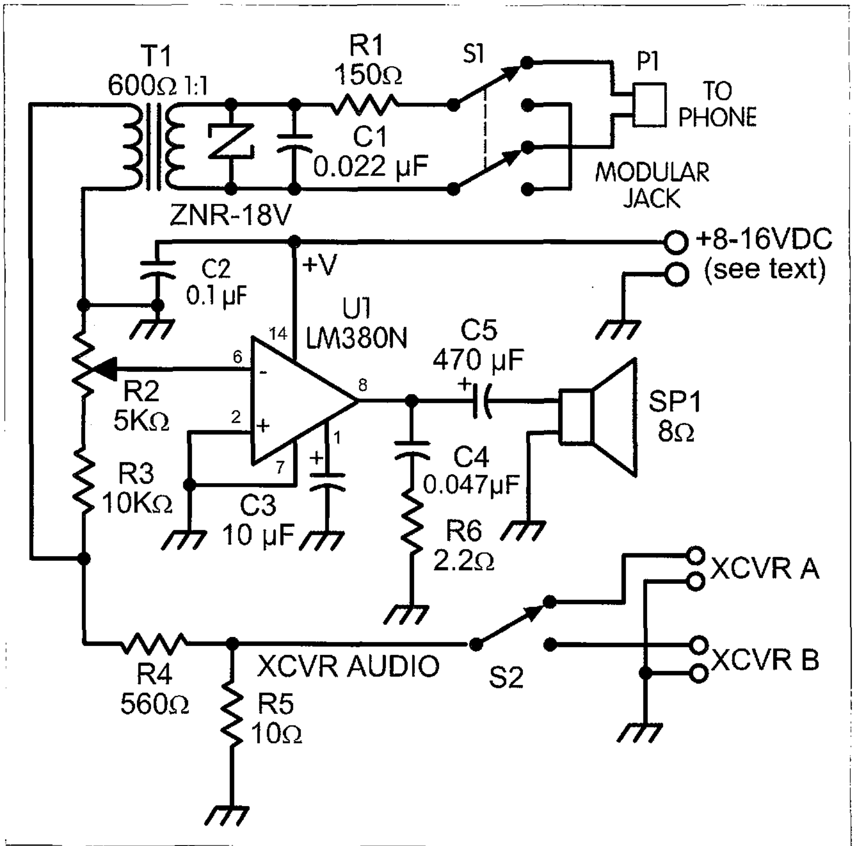


Fig. 1. Next time you get stuck on hold, listen to the music in comfort on the speaker of this combination telephone patch/telephone amplifier. Note: Ground pins 3, 4, 5, 10, 11, and 12 of U1 for heat sink.

Parts List

C1	0.022 µF; *RS 272-1066
C2	0.1 µF; RS 272-109
C3	10 µF 35 V RS 272-1025; **DK P5134-ND
C4	0.047 µF; RS 272-1068
C5	470 µF 35 V RS 272-1030; DK P5141-ND
P1	Modular jack; DK A9082-ND
R1	150 Ω 1/4 W RS 271-312; RS 271-1312
R2	5 kΩ Pot; RS 271-1714
R3	10 kΩ 1/4 W RS 271-312; RS 271-1335
R4	560 Ω 1/4 W RS 271-312; RSU11344801
R5	10 Ω 1/4 W RS 271-312; RS 271-1301
R6	2.2 Ω 1/4 W; RS 271-312
S1	DPDT switch; RS 275-327
S2	SPDT switch; RS 275-327
SP1	8 Ω speaker; RS 21-549
T1	600 Ω 1:1 transformer RS 273-1374
U1	Audio amp; DK LM380N
Z1	ZNR-18 V O/V protector DK P7282-ND

14 pin IC socket; RS 276-1999

PC board 2" x 3"; RS 276-149

* Radio Shack part number
** Digi-Key part number

Table 1. Parts list for the simple telephone patch/telephone speaker amplifier circuit.

been used quite successfully. The GE speakerphone cost $24.99 in a local discount store. The use of the speakerphone for a patch is as straightforward as having a visitor in the shack talking with your radio contact. The only "complexity" is that your transceiver's speaker and microphone must be near your speakerphone and that the audio levels are adequate. The speakerphone equipment handles all of the interfacing with the phone system. Thus there is no concern about overdriving the phone system or with providing proper fault protection techniques.

Yes, but what if I don't want to fork over the money to buy a speakerphone?

If you say that you have a quite adequate telephone at your rig and do not want to purchase a speakerphone just for the occasional phone patch, all is not lost. You can build a very simple patch circuit that uses all of these simplifications except for the one that requires the sophistication of a speakerphone (#3). Electing to forgo use of a speakerphone will, however, require that you provide an electrical connection to your transceiver's external speaker plug. Luckily, this connection is simple and problem-free.

The resulting patch circuit requires a speaker near your transceiver's microphone. In the example patch described below, a small but quite adequate extension speaker from Radio Shack™ was used. Even though this speaker is small, it had enough spare room in it to house the simple phone patch circuit. The patch circuit does not have to be packaged inside the speaker case. If you have an existing external speaker, it would probably be the best speaker to use. In that case, a small box can be used to house the circuit if you prefer not to modify the speaker housing.

Fig. 1 is the schematic of the simple patch circuit. Starting at the upper right of the schematic is the jack P1 to connect to your phone line. S1 is the switch that activates the patch and, when not in use, disconnects the phone line and shorts the input lines to maintain approximate impedance through transformer T1. When in use, the phone line couples through R1 to the line isolating 1:1 transformer T1. The value of R1 was selected to provide a total of 200 ohms DC resistance across the telephone line when switch S1 is closed. With the resistance of the particular

transformer used, this resulted in the choice of 150 ohms for R1.

The Z1 component is an overvoltage protector, while capacitor C1 filters out RF signals that may be picked up on the phone lines. The phone signal from the secondary of T1 is routed to gain reducing resistor R3 and the volume control R2. This volume control feeds the input of the audio amplifier U1. U1 drives speaker SP1 with power levels up to two watts, depending on the amplifier's heat sink. U1 runs on any voltage from +8 to over +16 volts. Thus you can run it on a nine-volt battery or use your rig's 12-volt source. You will find it is handy to run it directly from your 12-volt source so that the speaker is functional whenever your rig's power supply is on. C4 and R6 on the output of U1 are used to prevent high frequency oscillations.

In the bottom right of the schematic, two sources of transceiver audio are shown (A and B). This is done so that you can use the patch (for example) on either your VHF or HF transceiver. The selected audio signal goes to load resistor R5, which is then connected to the telephone line transformer secondary through 560-ohm resistor R4 to provide the approximate 600-ohm impedance desired.

Please note that the telephone output *and* telephone input both go to the same place—the secondary of the line isolation transformer. This is also the input to the audio amplifier and then to the speaker. This is how you know, if the speaker levels are similar for both the incoming telephone signal and the received radio signal, that the telephone signal levels are OK. The connectors for power and for transceiver speaker outputs are not shown, as they are unique to your particular power supply and transceiver(s). Be sure to ground U1 pins 3, 4, 5, 10, 11 and 12 and connect them to a heat sink if you want to run the full two watts from this amplifier.

Construction techniques are not critical. The example patch was easily wired up using the small Radio Shack perfboard shown in the equipment list.

Operating procedures

Normal: When the phone patch is off, the circuit operates as an amplified speaker system for your rig. You can select either source A or source B. One side benefit of the circuit is that it can also be used to monitor the telephone (by temporarily turning the phone patch switch on). This can be handy if you get stuck on hold and would rather listen to the music via the speaker than juggle the telephone handset while waiting.

Gain adjustment: This will set the approximate gain level for the amplifier and allow setting an appropriate audio output volume level for the transceiver.

The steps are as follows:

1) Tune your transceiver to typical signal (e.g., WWV) using the phone patch speaker.

2) Turn the transceiver off.

3) Turn the patch switch on. You should hear a dial tone.

4) Adjust the gain level on the patch circuit so that the sound is adequate to drive your transceiver's microphone. This should be adjusted to be quite loud, as most normal phone connections will be quieter than the dial tone. If you wait long enough, the telephone system will inform you by voice that "the time allotted for you to dial has been exceeded ..." This makes a nice test of adequate speaker volume.

5) While the patch is still turned on, turn on your transceiver and check the volume level. Set the audio level to achieve an equivalent or slightly louder volume than the dial tone/voice message.

6) Turn off the patch. The typical gain levels for your patch have been established. This gain setting is not critical as long as the phone signal into the speaker is loud enough to drive your microphone. It is important to keep your transceiver's audio output level similar to the received telephone signal so as not to overdrive the telephone.

Using the phone patch

Using the patch is very straightforward. Dial the party your radio contact wishes to talk with and explain the procedure for a radio call. After discussing the procedures with the tele-

Continued on page 49

Get Kids Involved—and Keep 'Em That Way!

Lessons from the "22 Crew."

Joseph J. Fairclough WB2JKJ
The Radio Club of JHS 22, NYC, Inc.
P.O. Box 1052
New York NY 10002

The Charlotte Hamfest '98 is now a memory, but the question most asked in Charlotte and at every other hamfest we have worked around the country (since 1980) keeps coming back ... over and over again. Here is the traditional scenario: A teacher sees our booth, reads the banner that shows our logo, makes the connection that we have a genuine school club display, and then immediately thinks of a million questions they had always wanted to ask but had never had anyone of whom to ask them.

A little history lesson first: The "22 Crew," our Radio Club of Junior High School 22, NYC, Inc., has been around since 1980. We started experimentally with 30 of New York's most educationally challenged—kids who would have been just as happy to shoot Spot (and maybe eat him) as to read about him (not to mention what they would have done to Dick and Jane)—a tough audience for a teacher. Being a ham, I thought it would be great to use radio as a theme to create interest and excitement in the classroom, to create sort of a ham radio theme park where we could still cover all the requirements of the 7th- and 8th-grade Language Arts curriculum.

To make a very long story short, it worked. I wrote curriculum based on ham radio. We formed a nonprofit organization to fund the program forever and preclude accepting aid from any government agency. After all, if this thing were to work it should support itself, and through donations of equipment it does so to this day.

> ***"Whatever the teacher has passion for will work—and work great."***

The original "Dirty 30" of 1980 has turned into 430 "22 Crew" kids per week, in NYC alone, who go through the program we called "Education Through Communication" then and "EDUCOM" now. The "Crew" has become NYC's largest ham club and the nation's only full-time, nonprofit organization working to get ham radio into schools around the country as a teaching theme.

Now, back to the question. Teacher approaches, says the usual of how they had heard of us, and then comes the biggie: "So, how do I get my students interested in ham radio?" And I give the answer, which really knocks them out: "I dunno!"

Well, we *do* know, but first we have to ask *you* some questions.

First, nobody has to get kids interested in ham radio—if it is presented right, they will *all* be interested. A teacher's enthusiasm is infectious and directly proportional to an idea's success. If you are so hot and turned on about gardening, use it. Stamp collecting, OK. Woodworking, fine—but if your thing is hamming, then listen up. The bottom line is: Whatever the teacher has passion for will work—and work great.

Assuming your thing is "working the world on a wire," the following may be of help:

• Get food. Candy, individual chips and pretzels, whatever, but make it kid food. Let 'em eat and work at the same time.

• Buy a broom. You may not know this, but the most important person for you now will be the custodian, not the principal. After the session, the room

Photo A. *As you might expect, the "22 Crew" classroom is not exactly spacious. Photos by Mark Grossman K2CON.*

Photo B. *Fifteen-year-old Anthony Ruiz makes a contact on 21.395, under the watchful eye of WB2JKJ.*

will be a mess. You clean it; later, the kids will. But for now *you* do it, and don't leave a mess. When you want to get to the roof or the electric box you'll need the custodian in your corner. He is now the main man in your operation. Cultivate him. It will pay off immeasurably!

• Don't get technical. Explain the basics—but be funny. Don't hope to license the world. Don't license anybody. Your job is to make a better kid via ham radio. If you make more hams, that is only a plus. Ham radio is like milk: It is not for everybody, but there is something in it for every kid.

• Operate. Show your fancy two-meter HT, but don't think it will last for more than one period. HTs wear off fast, and you must ... repeat ... *must* head to HF.

• Make contacts when you get to HF. Makes no difference where. Don't seek out DX. Kids don't care about that for more than five seconds. It is the regular, who keeps coming back every Wednesday at 1 p.m. to see how Maria and Tony are doing, who can have the most impact. These are the folks who will make you a star. Some of our best contacts are in New Jersey, not Timbuktu.

• Plan events. Stay late, get in early. Spend your own money. Be a *mensch* (ask me about that word). Let the kids call you by your first name or whatever they want. Some call me Joe, some call me Mr. Radio, some call me Mr. Joe—but whatever they call you, let them be comfortable.

• Be prepared to be hated by your friends and/or fellow teachers. When CBS and NBC and the papers and the school board and outsiders come to visit this marvelously innovative program, the folks in your building will get mighty jealous.

Success is now in your hands. This program will pass or fail largely depending on your own involvement and excitement. Go nuts and put all of your energy 24 hours a day, eight days a week, into this thing. It will pay off big for you, but most importantly it will result in big rewards for the kids, and *that* is what we teachers are really all about.

Interested in being a classroom winner? A real ham-star? You can contact

Continued on page 48

Photo C. *More of the "22 Crew" in action.*

Get Kids Involved—and Keep 'Em That Way

continued from page 47

us for intense and personalized help at the address at top, or call us anytime at (516) 674-4072; FAX us at (516) 674-9600; or E-mail us at [crew@wb2jkj.org]. We'll be waiting!

Meet the Marvelous MicroVert

continued from page 24

on 20 meters and making plenty of contacts, or not operating at all.

The MicroVert may also appeal to the experimenter. It is, after all, an interesting concept. I would love to hear from people about their experiences with the MicroVert or from anyone who may have a suggestion or two for improving it.

Acknowledgement

I would like to gratefully acknowledge the support and assistance of Margie Bachman KF4UVK, whose constant encouragement has made so many things possible.

Home-Brew this Power Cube

continued from page 28

end of the coil. Reconnect the 40- and 80-meter switch positions at the fourth and ninth turns of the new coil (counting from the 20 meter junction point). Use the entire length of coil for the 160 m position. Don't forget to leave an extra 10 inches of wire to reach the additional switch position on the ceramic end plate.

Before hard-wiring, use a grid dip meter to double check the resonant frequencies for each band. Adjust the tap, if necessary, for a good dip with about 30 percent of the capacitor plates meshed. You may find the need for additional capacitance on the antenna tune side. A couple of Jennings ceramic paralleled doorknobs toggled into the circuit solve that problem.

As you progress through the project, situations will undoubtedly arise that will require your attention. For example, the cooling fan may need replacement because of the higher heat-dissipating needs of the new tubes. The same is true for the stock HV plate parasitic choke (if you're anticipating drawing more current), as well as for any bypass capacitors if you've pumped up the plate voltage beyond the original ratings. The problems are not insurmountable—address them one at a time, and you'll find it's not an overly difficult task. Good luck, and I'll be seeing you on the bands!

Techno-Trouble II

continued from page 31

no conventional low-pass filter will do a darned thing.

45. *False*. But almost true. You must show up with your ham license, and show it to them. If the station is not being used otherwise and they are open, they'll let you operate within your license privileges.

46. *False*. Neat idea, but against the rules in almost all contests.

47. *False*. Against the rules. Read 'em and weep.

48. *False*. Six meter Es (sporadic-E propagation) peaks in June and December. In December 1997, the author worked from the Caribbean to New Zealand from his home station in California, with no special equipment or antennas.

49. *False*, but a slightly trick question. It has been suggested there is a link between the solar activity that causes lightning and that which causes sporadic-E propagation, but the link appears to be solar wind, rotation and other issues. There has never been proved a direct correlation between lightning and E-skip. The indirect correlation remains somewhat of a mystery.

50. *True*.

Continued on page 49

Techno-Trouble II
continued from page 48

So how'd you do this time, huh? These, like the first 50 questions appearing in April, are relatively easy, with a few twists just for fun. If anyone gets these 100% correct, I'll eat a bug. 73 ...

In Search of a Simple Phone Patch
continued from page 45

phone party, turn on the patch and then hang up your phone. Next, tell your radio contact that "your party is on the line." When the radio contact wants to listen and tells the telephone contact to go ahead (e.g., "over to you"), put your transceiver in transmit while making sure your microphone is near the speaker. When the telephone contact wants to listen, switch your transceiver back to receive. You can adjust the gain of the patch and/or your transceiver as necessary to maintain adequate levels. In case of difficulty, you can pick up the telephone at any time to discuss the situation. Make sure you turn the patch off when finished, as it acts like an off-the-hook telephone when on.

Note: If your telephone is too close to the speaker and/or the gain of your patch is too high, you will get feedback oscillation. The easiest fix to this issue is to make sure your speaker and telephone are several feet away from each other. (Conversely, if a speakerphone were being used, you would want it to be close to your speaker.)

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Wayne's Five Buck Books:

100 Books You're Crazy if You Don't Read. Brief reviews of books that will help make you healthy, wealthy, and wise. If you are sick you did it to yourself through messing up your body. This is probably the single most important five bucks you'll ever spend.

How to Make Money, A Beginner's Guide. Commuting to work is stupid. You can't get fired, laid off, downsized or outsourced if you own your own business. This is an instruction book on how to get others to pay you to learn what you need to know to be independently wealthy, have a ball doing it, and have that ham shack you've dreamed of.

Grist I. Fifty of Wayne's recent non-ham oriented editorials. They're about almost anything and guaranteed to almost make you think. You'll sure have things to talk about on the air other than your antenna and the weather.

Grist II. Fifty more non-ham editorials. Even more fascinating stuff to think and talk about.

One-Hour CW Course. How anyone can pass the 5 wpm code test with less than one hour of study. This also explains the simplest system for learning the code at 13- and 20-per ever discovered. Or, do it the old fashioned (ARRL) hard way and suffer. Your choice.

Number 50 on your Feedback card

Carr's Corner

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

What kind of knowledge?

Ham radio can be viewed from a number of perspectives. It is an operating hobby (ask any DXer). It is a rag-chewing hobby (look at any band!). It is also a technical hobby. Amateur radio technology is based firmly on scientific and engineering knowledge. Without scientific knowledge, we would not have transistors and power tetrodes, never mind yagi antennas and single sideband. All of those neat things came to us because someone, at some time, did a little science.

Science and engineering are intimately related, but are not the same thing. I remember a debate in a college physics class where the friendly argument was whether engineering was "physics lite" or science was engineering with attitude. I suspect it depends on your perspective. I upset a number of members of that class with the statement "all science is either physics or butterfly collecting." The only problem is that the room was full of chemistry majors. Sigh. The distinction I was making was that science tends to do things either as physicists do them, or as botanists do them, and not to imply that one was better than the other.

It's my turn to rant. Scientific knowledge is superior to other forms of knowledge. This claim does not mean that knowledge of engineering, chemistry, and physics is superior to knowledge of history or social issues. But rather, that knowledge that is obtained through a systematic, disciplined process—which we call the scientific method—is far superior to "knowledge" obtained through random guesses, hunches, intuition, or any form of non-systematic approach. Much of what passes for "knowledge" in everyday life is not knowledge in a scientific sense. Even when empirically derived ("experience"), unorganized observations cannot rise to the level of scientific knowledge.

One view of science is that it is a filter that helps us sort things out. Our knowledge of the real nature of things is often distorted by any number of factors resulting in a lot of "noise" on the "signal" of knowledge. The purpose of scientific method is to provide a filter that removes as much of the noise as possible, leaving only the underlying knowledge. And while the process isn't perfect, it is far above the random ranting of those who use other methods or no method at all.

Science provides a framework for, and examples of, effectively handling problems in a systematic way, so the scientific method should be the mainstay in the armamentarium of all thinking people.

At least some variant of the scientific method is applicable to dealing with most issues that confront us today in business, in the professions, and in public life. The thoughtful executive may not think of herself as a scientist, but the reasoning processes are common to both fields.

In 1942, Robert K. Merton proposed some "norms" that are characteristic of science. These are detailed below.

Originality. A hallmark of scientific studies is that they are original. With the possible exception of studies that are intended to replicate the work of an earlier study, the purpose of the scientific study is to somehow add something to the knowledge base. Studies that contribute neither something new, nor confirmation or refutation by replication of previous studies, are not true science.

Detachment. The only legitimate motive for scientific activity is the advancement of knowledge. One source goes so far as to question whether or not scientific research conducted for industrial or defense purposes qualifies as "detached" and thus "science." The argument is that when monetary or other motives (e.g., ideology) impinge on the scientific process, the goodness of the science involved deteriorates. It is in this area that some of the most sensational scandals have erupted. We disagree, and note that such factors are a caution, to be sure, but do not necessarily degrade the scientific objectivity of the researcher.

Universality. The claims of scientific studies should be verifiable by anyone, anywhere, provided (of course) that they are equipped with the right apparatus and follow the same procedure. No special sources of information are permitted. Claims are based solely on the intrinsic merits of the data. No extrinsic factors such as religious, social, ethnic, racial, or other prejudicial beliefs are permitted a place in the deliberation.

Skepticism. The scientific study proceeds from, and should be judged, on the basis of evidence alone. Nothing is accepted on faith; no one is trusted who has no data to support the claims being asserted.

Public accountability. Central to scientific goodness, the basic quality of scientific studies, is the matter of public accountability. The scientist places his or her data in the public square and lets the critical hordes attack it for all they are worth. It is the accountability of peer review that makes scientific studies less likely to be poorly done than "private" studies.

A frequent cause of scientific failure comes from uncritical acceptance of a framework of ideology that causes leveling or sharpening of the data in order to support a pre-existing result. Whether incidentally or by design, this problem is very widespread today.

Decisions made by thoughtful 21st-century people should be based on data collected and analyzed according to the principles of science and reason, not on emotional trash. Today we are beset by junk science to support any and all issues. Indeed, it doesn't even seem to matter which side of the political spectrum the argument is on. What seems to be the predictor of whether or not people offer junk reason and junk science instead of reason is the intensity of their commitment to the issue.

We in ham radio see our share of those issues. Remember the scare over cancer and other illness induced by radio waves and other electromagnetic sources? The truth, as best we know it, turns out to be somewhere in between the "ain't no such problem" and the "the sky is falling in" positions.

Whether the issue is a quack medical device or treatment, a controversial public policy, or purely personal matters, we owe it to ourselves to use reason and scientific method to make our decisions.

Special event station

The Lake Area Radio Klub (Watertown SD), Huron ARC (Huron SD), Radio Research Club (Brookings SD), and Deuel County ARC (Clear Lake SD) will operate special event station KBØTAH from 1700Z July 4 through 2200Z July 5. Operation will be from "The Little House On The Prairie" (Laura Ingalls Wilder Pageant) on the following frequencies: 3.870, 7.250, 14,250, 21.350, 28.415, and 50.135. Certificate: SASE to LARK, Box 642, Watertown SD 57201-0642.

1998 US Air Force QSO Party

In response to an enormous number of requests following the Air Force 50th Anniversary

QSO Party in September 1997, the AF Anniversary QSO Party is now an annual event! It will be held on the third weekend of September 1998 from 0001 UTC on September 19th until 2359 UTC on September 20th. Full rules are at The Razorback Radio Club Web site: [http://ourworld.compuserve.com/homepages/k5xs].

The purpose of the annual event is gathering on the air as many active and former members of the Air Force as possible for a weekend of fellowship and in remembrance of all those who served.

Point identifiers will be used to identify participants' Air Force experience. The point values will be determined by subtracting the year the participant entered the Air Force from the year 1998. For example, people who joined in 1947 will have a point value of 51 (1998 - 1947 = 51) and will identify "/AF51" on CW or digital modes, and "Air Force fifty-one" on voice. People who joined in 1988 would have a point value of 10 (1998 - 1988 = 10) and would identify as "/AF10" or "Air Force ten." Participants without Air Force experience will identify as "/AF1" or "Air Force one."

Participants may use experience in any Air Force component (active, Air National Guard, or Air Force Reserve) to determine their point identifier. Members of the Air Force auxiliary, the Civil Air Patrol, may use point identifiers based on when they joined CAP as a cadet or senior member. Previous members of the USAF parent organization, the Army Air Corps, may use a point identifier of "AF51."

In 1997, the final score was determined by totaling all of the point identifiers for all of the stations worked. For 1998, they are adding a multiplier which will be determined by counting the number of different point identifiers worked and multiplying your score by that multiplier. For example, if you work four stations with point identifiers of "AF8," "AF22," "AF8," and "AF4," you would determine your final score by first adding together all of the point identifiers (8 + 22 + 8 + 4 = 42) and then multiplying that number by three (since you worked three different point identifiers: AF8, AF22, and AF4), for a final total of 126 (42 x 3 = 126). (Note that you can count each identifier only once for the multiplier. So in this example, you can count "AF8" only once as a multiplier, even though you worked two "AF8" stations.) This new scoring scheme should encourage more "hunting" for even the smaller point identifiers, since it will be in the best interest of participants to work as many of the 51 different point identifiers (AF1 through AF51) as possible.

They will also be awarding point bonuses for working stations operating from the premises of Air Force installations worldwide. All stations (club or individual) operating within the boundaries of an Air Force base will identify the name of the base they are on. For example, K5TYP (the Mississippi winner for 1997) will identify "K5TYP, Air Force 51, Keesler Air Force Base." The Razorback Radio Club station on Hickam Air Force Base will identify "K5HOG, Air Force 24, Hickam Air Force Base." For each of those stations you work (even if more than one are on the same base), not only will you count their usual point identifiers (and use them to compute the multiplier above), but you will also earn a bonus of 100 points per station to be added to your final score. If you work four stations located on AF bases, you will add 400 points to your score.

To summarize how 1998 final scores will be computed, you will:

Step 1. Add the total of all point identifiers of all stations worked.

Step 2. Count the number of different point identifiers worked, and multiply your score in Step 1 by that number (maximum multiplier will be 51).

Step 3. Count the number of stations worked that were operating from Air Force installations, and add 100 points for each of those stations to determine your final score.

A score calculation worksheet is available for download at The Razorback Radio Club Web site.

Clubs may use as their club point identifier the point identifier of any bona fide club member.

Contest CQ calls to be given as "CQ AF" on CW and digital modes, and "CQ Air Force" on voice. Operation is allowed on any authorized frequency, but frequencies ending in "47" (to celebrate 1947, the year of the USAF's formation as a separate service) will be encouraged as meeting places (e.g., 3547, 3947, 7047, 7247, 14047, 14247, 21047, 21347, 28047, 28447). Exchanges should consist of callsign with point identifiers and signal reports (e.g., CW/digital: "K5HOG/AF24 de K5XH/AF1 599 K"; voice: "K5HOG Air Force Twenty-four this is K5XH Air Force 1, you are five by nine, over").

Log submissions for awards must include for each contact the callsign of the station worked, its point identifier, date, time, frequency, and mode. Each page must have point identifiers totaled at the bottom of that page. Each log submission must include on the final page the following:

1. The total of all point identifiers.

2. The multiplier claimed.

3. Bonus points claimed for working stations that are operating from the premises of a US Air Force installation anywhere in the world.

4. Total points claimed.

5. A declaration as to whether the station is competing as a

Continued on page 52

Number 52 on your Feedback card

Ham to Ham

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. Part 5 of that series appeared last month; part 6 follows.

Lightning protection—what your mother never told you!—Part 6

Special installations

Let's talk a little bit this month about high-rise installations. Our definition of a high-rise building, such as might be used for an amateur repeater installation, is different from that of a multilevel house, because the antennas on a high-rise are not on a ground-mounted tower. Because of this, the single-point grounding plan is an absolute must for any high-rise equipment room. Grounding both the antenna and the single-point system in the equipment room is usually pretty easy for buildings with structural steel framework ... just bond directly to the building steel.

Buildings that do not utilize steel construction aren't as simple. Some high-rise buildings have a fire riser which has a "home run" (direct drop) to the basement, where a supercharger pump is usually located. The riser may be used as a ground path if the pump's power is properly protected (three-phase), and a strap jumper is installed to take the strike energy past the pump's gasket (on both its input and output ports). If the riser is more than 50 feet away from the equipment, it may not be the best ground path to use. Check for other paths, such as existing building lightning rods with down-conductors, or large electrical conduits. Do not use drain pipes or vent stacks. If these first alternatives are not available (regardless of the path distance) and it is impossible to run a heavy strap down the side of the building, then the antenna cannot be earth grounded.

When a nongrounded antenna is hit by lightning, the energy will traverse the coax line to a single-point equipment ground location. This may be many meters away from earth ground; therefore, the inductive/resistive voltage drop can be very large (hundreds of thousands of volts when dealing with lightning). The objective, then, is to allow equipment to "float" at high potential. The correct grounding plan achieves a single-point ground with no sneak paths. Sneak paths are loops that allow lightning current to flow into the equipment room with the objective of seeking out a "lesser" ground path.

Power safety grounds and concrete floors are the most common sources of sneak (lesser) paths. A power safety ground can be fixed by adding a distribution panel and protector at the single-point grounding location for small sites (a plug-in protector grounded on the single-point grounding panel). All I/Os must be protected at this single point. During a strike, distance equates with the voltage drop to earth; thus the entire room of equipment will be elevated above ground. Sharp corners on equipment cabinets can break down the air (ionize the air), causing current streamers to flow. These will be of very low current, unless an inadvertent sneak path is found by these streamers. Heater vents and electrical conduits, not grounded to the single-point system, can become such inadvertent paths (unless these vents and conduits are connected to critical equipment which cannot handle such surge currents at the lower floor equipment location). It is a good idea to ground (to the single point) all conductive objects within one meter of any single-point-earthed equipment in the room. Dealing with a floating equipment room requires a slightly different mindset, and careful inspection and layout should be paramount in its protection design. Tower-mounted equipment is similar to the above high-rise situation. The I/Os must be safeguarded and the protectors must be located and bonded together. Single-point grounding should be easy to accomplish if the equipment is mounted inside an approved metal enclosure.

That's it from Roger and Ron for this month, but the "Ham To Ham" column will continue this series on protecting your ham station from the destructive effects of a lightning strike—part 7 is coming up next month.

Look for the silver lining

From Mike Leahan N9PQK: A clever tip on turning what's normally a problem into a solution: "I was in the final stages of construction of Ten-Tec's 2 m to 6 m transverter kit when I found myself in critical need of a signal generator to align the receiver section of the transverter. Not having a low-power six-meter signal source, I happened to remember my shack computer—you know, the computer that outputs birdies right on the frequency that you want it not to interfere on! If all clouds do have a silver lining, as the saying goes, maybe I could find one of those birdies on six meters to help me through this particular dilemma.

"Sure enough, there, right in the middle of the six-meter band, was a signal from my computer that was just the right strength to allow me to peak up the receiver section well enough to bring its sensitivity up to the point where I could then leave the final tweaking for a suitable off-the-air signal later on. The transmitter section tuned up nicely using a VHF SWR/power meter in-line into a dummy load and I used a VHF tunable receiver to check for out-of-band spurs, but the computer (with its plethora of harmonics) saved the day for initial receiver sensitivity alignment. It's a good suggestion to keep in mind the next time you need a signal source and haven't a generator available for that particular band or frequency grouping. Maybe clouds do have silver linings?"

Think *up*, not out

From Tom Hart AD1B: A tip for getting more mileage from your limited desk or shelf space: "Having a rather compact desk

CARA's Corner

continued from page 51

single-operator or multiple-operator station.

6. Signature of the licensee or other participant.

Logs must be received by The Razorback Radio Club not later than October 15, 1998, for award consideration. They may be submitted by E-mail (ASCII text file only) to [k5hog@aol.com].

Awards for 1998 will include plaques for overall worldwide single and multiple winners, and certificates for high single- and multiple-operator stations in each country, state, and province.

Further information is available by mail from The Razorback Radio Club, 604 Julian Avenue, Honolulu HI 96818, or via E-mail at [k5hog@aol.com] or [k5xs@compuserve.com].

for my ham station, I have to integrate new items of equipment somewhat carefully and by using a bit of 'ham ingenuity.' Since my monoband transceivers and their associated antenna tuners for two meters, six meters and 10 meters took up way too much precious space when sitting side-by-side, I designed the stacking-bracket system shown in **Fig. 1** as a nice alternative.

"I purchased some 1/4" x 2" x 24" oak strips at a local lumberyard to build the support system. Mine worked out well using four-inch strips for the horizontal pieces and five-inch strips for the vertical supports, but these dimensions may vary somewhat with different sizes and configurations of equipment. In addition to saving that valuable desktop and shelf space, the stacking-brackets allow items of equipment of very different sizes to be one above the other, without the danger of scratching cabinet tops or covering vent holes as might be the case if the two items were in actual physical contact. The two items of equipment can also be slid out independently to some degree, which wouldn't be possible with direct stacking. The bracket's vertical section can even serve as a nice spot to put a hand-held microphone.

"The time needed to build the stacking-brackets was minimal, the cost small and the results very satisfying."

Moderator's note: Nice idea, Tom. If you don't want to drill holes in the sides of the top piece of equipment, you can still use Tom's idea by making up a bottom board for the top piece of gear, perhaps using two vertical supports per side instead of one.

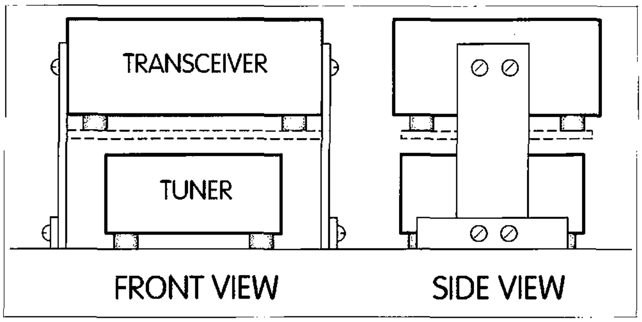


Fig. 1. AD1B's stacking-bracket idea to conserve desktop and/or shelf space, while at the same time allowing equipment of different sizes to be neatly stacked one above the other. If your transceiver doesn't have side-mounting screws, a shelf arrangement may be used instead.

Don't pan this idea!

From John Nix: "I recently visited a store in my area that specializes in liquidating damaged merchandise (from insurance claims salvage, etc.), and my eye was caught by some of the variety of rectangularly-shaped roasting pans that are available today ... for ham radio and electronics use, of course!

"Years ago, I had thought about mounting a particularly sensitive printed circuit inside a cake pan that sported a sliding metal cover, to protect the delicate components inside from possible static damage. Today, however, the array of cookery cleverness is even broader, so it may pay to stop and browse the next time you're in one of the stores that specialize in kitchenware.

"Some of the aluminum roasting pans could easily be converted into an inexpensive housing for a home-brewed monoband transceiver, antenna matching unit, or, fitted with a hinged lid, even a rugged airline carry-on for your ham rig or laptop computer. The secret, if that's the right word, is to try to look at these cooking containers from a different perspective than the manufacturer had in mind when he made them. 'Old-fashioned ham ingenuity,' I think it's called. Cooking containers are usually built very well, to stand up to years of high temperatures, scraping and washing, and yet they're often priced very reasonably, because of the mass production and mass marketing of them, unlike some of the lower sales volume cases that are ordinarily seen in the electronics parts catalogs and stores.

"So I guess the bottom line is this: the next time you need a sturdy enclosure for your ham radio or electronic project, take a look in the cooking section of stores first ... you might just end up with the right recipe!"

Stamping out twist-ties

I've run into a number of ham transceivers that utilize those metal wire (encased in plastic) "twist-ties," used to hold bundles of wires together within the interwiring of the unit. No doubt this shortcut speeds production, but I've often wondered whether anyone has ever encountered a short due to the use of these conductive ties (conductive at each end, at least). I've never encountered a problem that I could directly relate to a short or intermittent attributable directly to the use of these "ties," but it nonetheless seems a somewhat risky choice for use inside an expensive piece of electronic equipment. As I find them inside ham transceivers and other related gear, I've been replacing them with either small plastic "zip-locked" cable ties, or with waxed lacing cord formed into single-loop style of ties. It seems a much better choice, and time well spent, if it leads to less potential for problems in the future.—de NZ9E.

Murphy's Corollary: A Volt-Ohm-Milliampere meter will always be in the "milliampere" position when a voltage reading is first taken, thus shorting out the circuit under test and blowing the fuse in the meter. The only exception to this rule is when the meter has been inadvertently left in the "ohms" position, in which case the meter's oddball ohms-multiplier resistor will be destroyed.

Thanks go out to those who've steadfastly supported this column with their tips, suggestions, cures for our common problems, and innovative ideas ... and especially this month to:

Roger and Ron Block
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Mike Leahan N9PQK
310 Lincoln Court
Sun Prairie WI 53590

Thomas Hart AD1B
54 Hermaine Avenue
Dedham MA 02026

John Nix
9123 Hwy 23 NE
Foley MN 56329

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to *73*'s "Ham To Ham," c/o Dave Miller NZ9E, 7462 Lawler Avenue, Niles IL

Continued on page 54

Number 54 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

Great SSTV for the truly budget conscious

Here is a way you can start transmitting and receiving slow scan television with an exceptionally low cash outlay. A while back I wrote about doing SSTV with a program that utilized your Windows 95™ computer equipped with a sound card. So what do you do if you have an older machine without these popular amenities?

You can still do it for under $25! Those of you who read about and built K7SZL's [http://www.accessone.com/~tmayhan/index.htm] serial interface to do RTTY and other digital modes can get started with no cash out of pocket. John Langner WB2OSZ makes available, through Absolute Value Systems, [http://www.ultranet.com/~sstv/lite.html], Pasokon TV Classic, TV Lite and Easy SSTV (the free taste-test version).

The version I am using is TV Lite. It sells for $30. The Easy SSTV is free as mentioned. Then, after you have been thoroughly bitten by the bug, the TV Classic is available for $200. It includes a board to install in your computer and claims much easier use and quality.

These are not Windows™-based programs. You do need a 486-based computer with a minimum of eight megabytes of memory and a VGA monitor. This still puts SSTV out of bounds for the XT and earlier AT computers, but the average 486 with no sound card will do as long as you have enough memory. And that, considering the used prices on three-year-old computers, is really getting into the low budget price range.

You will need a simple serial interface. In my case, I already had the one I mentioned above. There are other serial modem plans available and this software also comes with information to build yet another slight variation. My modem is now housed in a box that will just about hide in an eight-ounce cup.

To do something a little more mobile, I set up the software in the IBM 365XD laptop. It has all the qualifications plus a slight advantage in the monitor department. The desktop, though it now sports a Pentium™ processor, is still working with a 256-color VGA system instead of the now-popular "millions of colors."

Photo A gives an idea of some of the capabilities of Pasokon. There is a text editor and graphics utility that permits on-the-spot edits. If you look closely, you will notice the image is skewed slightly to the left. This was an early shot before the program had settled down and made its automatic adjustments.

As a little aside, when I hooked up the serial modem to my HF rig, I realized I was in trouble if I wished to work this mode. The cable was wired for the microphone jack of the ICOM 735 and it is necessary to converse with hams via SSB in between sending and receiving images.

Something new (to me) to try

Before I made the new cable, I decided it was time to revisit the HamComm software and, not finding any RTTY signals at the time, I did something I had never attempted: made a CW contact via the computer. The HamComm software copied on a catch-as-catch-can basis as does most CW software I have observed (you gotta listen close), but the PTT and the transmitted Morse code were flawless. I guess I should expect it to be that good, it just seemed ... well ... so effortless. Plus, while typing at just slightly over 15 wpm I could keep the spelling up to par.

So, back to the cable hookup, it was merely necessary to run four wires into the accessory jack on the back of the 735 and it was ready to play again. My timing was a little off, as I picked a day when the SSTV activity was on the low side. The well-seasoned were complaining about conditions. I didn't care about conditions; I just wanted to see this work—and it did, marvelously.

A contact was made with Bob,Bob (he emphasized the proper pronunciation of his moniker) WB5UZR. I had received some great images from him while monitoring his previous contact. Bob,Bob was a fountain of information. He received the one and only image I had in the laptop at the time which was evidence that it was working. Previously, the only hint of successful transmission came from sending the image into the bucket of oil (dummy load) under the operating desk.

More to hamming than signal reports

This was a good contact in that Bob,Bob shared many of his experiences while working with digitized images and told me about his equipment. I came away very impressed that there is more to this ham radio hobby than just simply exchanging signal and weather reports. I had met someone who really enjoyed the background work of enhancing and caring for his digital pictures. Claiming a gallery of thousands, he must have a *huge* hard drive.

The software is quite intuitive. As is my downfall with most pieces of software, I had read very little of the extensive on-line documentation; I had to get into *using* it to see how easily it responded to my natural instincts. One of those habits is to hit the "Enter" key without thinking ahead. It never got me in any trouble.

For a time, I felt the way to induce the program to get into the "Receive image" mode was to move the cursor via mouse to the "Receive" button and click it. Not necessary. As I learned, all that is needed was to hit that "Enter" key. When it is time to quit receiving, hit the "Enter" key again and the system goes to standby. Time to transmit, hit "X." To abort transmit, hit "A." Just that simple.

As you inspect the screen layout you will notice it resembles a Windows program in many ways. There are pull-down menus, buttons to push and, with a DOS mouse driver installed, you can control the screen activity quite easily. I did eventually find it necessary to read the documentation. There were just too many surprises. Spell surprises, *features*. I have not seen the freebie program EASYSSTV, nor the high-end version, but this program allows a lot of latitude to cover the needs of the occasional SSTV user.

I attempted to make screen shots or dumps of the screen so you could see the layout of the program, to no avail. Then I took some photographs, but the prints, though of good quality, were dark and wouldn't scan well enough. You will just have

Ham to Ham

continued from page 53

60714-3108, USA. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

***Photo A.** This was, at the time, the only image I had in the computer to send. The SSTV program made it easy to add the text. There was no response to sending it, but others do send such images. Most hams keep many images on file to show and exchange with their friends over the air.*

***Photo B.** This is an example of what happens as signals fade. Since it takes nearly two minutes to send a frame, when the conditions change blemishes appear on the screen. As better filters are used at the receiving end, these problems disappear.*

to use your imagination with the following brief description.

How the program looks

Across the top of the screen are the expected pull-down menus that operate either by clicking or use of a mouse as would be expected. In the upper left-hand corner is a tuning indicator. You will find this very effective and useful. It works any time you are in the receive mode. Also in that corner is a graphics toolbox for touchup, in addition to the text capabilities.

The rest of the left side is a panel allowing selection of different operating modes, including Scottie, Martin, Robot and Wraase. It is customary for the sending station to identify the mode verbally, before transmitting. In the lower left corner are the various receive, transmit and standby controls.

Along the bottom are thumbnails, icon-sized pictures you have saved so you can select one of several immediately. Also, the received image will locate itself there as soon as the picture is received, so you may refer back to it, save it or retransmit it yourself.

One of the good experiences of the program was that it installed and worked flawlessly. I like that; so does the wife. When things work right out of the box, I am much easier to live with.

The program is hungry for interrupts, so it is necessary to run it directly from DOS and not from a DOS window out of Windows. With Windows95 press "F8" when the system is booting and the "Starting Windows95" displays, then choose "6" from the menu. Some programs I have found with these requirements become unstable and crash easily. I have as yet to experience this with Pasokon, a good sign.

In the hopper

George SV2AGW sends word that he has licked the printing problem in his free Windows95 packet program I told you about last month. He is a very busy ham, plus he tells me his family is in the shoe manufacturing business which would often be enough to keep most hams away from the hobby. Must be a tough guy.

The LDG Electronics packet modem is still on the back burner. Dwayne at LDG has been quite helpful. I should have that going by next month. Another low-budget item for the digital arsenal.

Also, I found why I had such a rash of messages about the Web address for PCFlexnet. It seems that a hyphen had been edited out of the address during layout. The hyphen in question happened to come at a deceiving line break and looked perfectly natural to omit. Note the hyphen following [http://dl0td.afthd.th] in **Table 1**. It's gotta be there!

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130.1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @ N7NPB.#NONEV.NV.USA.NOAM]. For now, 73, Jack KB7NO.

Source for:	Web address (URL)
HF serial modem plans & software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free prgms	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 prgms	http://www.forthnet.gr/sv2agw/
BayCom - German site	http://www.baycom.de/
Pasokon SSTV prgms & hardware	http://www.ultranet.com/~sstv/lite.html
VHF packet serial modem kit	http://www.ldgelectronics.com

***Table 1.** Current Web addresses (as of this writing) mentioned in the text. There are more, and I will add to this group and post it frequently. All of the above were cut and pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later. See text.*

Number 56 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Avenue, N.E.
Palm Bay FL 32907-1371
[pangen@compuserve.com]

Drilling for talent

For the past few months we've faced a wide range of weather problems associated with *El Niño*, and now we are being warned about even more severe problems which may appear with its counterpart, *La Niña*. Although it is true that the news media seems to delight in predicting terrible (and therefore interesting) situations, it's in our best interests to maintain our level of readiness just in case they're right.

Field Day is one opportunity to practice some of the skills needed in an emergency, of course, while having some fun in the process. It's a chance to see the faces behind the familiar voices on the local repeaters. It's also a great opportunity to rack up some serious contacts. On the other hand, it is pretty much a hams-only event rather than one which includes others with whom we'd work in an emergency.

If your community maintains plans for various emergencies (and they do), ideally they also should hold drills on a regular basis. Unfortunately, even in times of a good economy, government agencies find that they do not have the funds to cover everything they wish to do. A disaster drill is a tempting target to drop from the budget. Dropping a drill will save the agency both time and money, so drills may be sporadic. Likewise, a community which has faced one type of emergency will have used its available funds for relief efforts. Not only will it lack funds, but those who work in disaster relief want a break more than a drill. Finally, because government agencies by definition are political entities, even when a drill is held, other governments or agencies who could may choose not to participate since it may be viewed as "Their" drill, not "Our" drill.

If your community office of disaster services has no plans for a drill in which the ham community could participate, there are other options. Hospitals need to conduct disaster drills on a regular basis to maintain their accreditation. Since many hospitals prohibit cellular phones and transmitters which could interfere with patient monitoring equipment, it may be useful to find out where or how hams could operate in support of a hospital before an emergency occurs. School systems may hold periodic tornado drills, and the airport may be required to conduct air emergency drills. If you have good connections with the community, there should be no problem finding opportunities to practice.

During a recent nuclear disaster drill I got into a discussion with Ken Johnson N4ZEB about the type of support we could expect from the ham community. We are fortunate to have a very large ham population, with over 400 licensed amateurs in this city alone. Our end of the county was tasked with two sites for reception and/or decontamination of victims of the disaster, as well as checkpoints at the major roads into the area. We also were expected to provide communications for up to 11 shelters as well as net control and liaison with the police department. We had nine amateurs actively involved in the drill and several others who joined us as mobiles for some portion of it. As we talked, I realized that there are several categories of responders within the ham community.

The first group are those who not only have a high degree of commitment and enthusiasm, but also have the flexibility to respond under many conditions. These people include retirees, those whose work schedules are very flexible and/or those who are on the road as a part of their job. In many cases, these folks are the backbone of any efforts.

The second group are those who are every bit as interested, but whose schedules are less flexible. Most drills are held during regular working hours so that those who are involved in the drill as part of their jobs do not incur overtime. (As a taxpayer, I appreciate this.) Some hams who would respond quickly during an actual emergency cannot afford to participate in a drill. In the event of a real emergency, many of these people use vacation or personal time to help out. Others have employers who will permit them to take time off work for disaster relief efforts but not for drills. These hams are the key to sustaining operations in a real emergency for more than just a few hours.

While there are many people who won't assist in an emergency, they tend to be a minority. There are some who appear as if they can't help, but don't be too quick to dismiss anyone. While someone who is confined to a wheelchair or blind may not be able to walk through a storm scene doing damage assessment, he or she may be your best choice for net control. Ham radio is truly an arena in which your abilities are far more important than your disabilities.

Number 57 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

Do you like flea markets? Certainly, one of the attractions of the rows and tables of old stuff is the thought that somewhere, buried among all the junk, is that gem you have been looking for. Well, over the past score or so of years, this column has been many hams' source for *materia teletypia*.

To begin with, many hams have asked about finding manuals for older teleprinters. Wayne Hall WB4OGM relates that he has a big manual of NAVSHIPS instructions for maintenance, assembly, disassembly and so forth for the old Teletype Model 15 and 19 sets. He is willing to make copies of any parts that readers of this column need. Contact him directly at [hwhall@compuserve.com], or write him at 5085 Escapardo Way, Colorado Springs CO 80917 for details.

Now, while we are all rummaging around in that flea market, can anyone help one of our readers? A reader signing himself "Heartbeat" [heartbt@sault.com] passes along the following question: "I was wondering if you had a back issue concerning the Emperor 5010 final swap. The finals that are standard are not being made anymore and there was an article (somewhere) that described the process of upgrading the finals to 100-watt, easy-to-come-by finals."

Well, I am at a loss on this one. If anyone has information on this unit, pass it along to "Heartbeat," and let us know, as well.

Dave Hough KC7DM, another fan of the page for years, passes along the following:

"Enjoy the page. Been active on and off since 1959. First got on RTTY in mid '70s with a TT7FG (military nomenclature for a Model 15). Then rebuilt a Kleinschmidt TT-76 reperf and a TT-100 page printer. Still have them.

Been inactive on HF for about 15 years. Got rolling last summer and putting together a RTTY setup to work with the Collins S-line. 'RTTY Loop' got me pointed in the right direction. Am also going to get the Kleinschmidts on air."

Dave passed along the photo in **Fig. 1**, showing a beautiful station from some 20 years ago, when this column was just learning to walk. Thanks, Dave, for the glances backwards and forwards.

As one gets onto RTTY, the need for some kind of test equipment often arises. Unfortunately, that which was once easily available is now not always so. John Fail KL7GRF, of Bayfield, Colorado, writes:

"I am getting back on the air after several years off. I was very active on RTTY in the late '60s and early '70s. I wonder if you know of any sources of a low cost, small oscilloscope that I could purchase and hook up to my MFJ-1278 TNC (it has the internal tuning indicator board installed) for use as a visual tuning indicator to make it easier to tune signals in. Or possibly I could build one if you know of any articles that have appeared in the past although my collection of past issues of all ham

Continued on page 58

ON THE GO

continued from page 56

Who does this leave? A lot of folks who feel that they have the skills to respond in a real emergency but do not need to commit time for drills. While it's easy to be confident of one's own skills, this may be a flawed approach. Let's work under the assumption that everyone needs practice to do any particular task well. Our hobby use of ham radio is helpful, but not always representative of exactly what we would be doing in an emergency. We need direct, relevant, hands-on practice to keep our skills sharp. After all, we expect this of others. If your doctor had performed hundreds of tonsillectomies, would you let him perform heart surgery on you? Of course not—you'd want someone who had significant experience in exactly the procedure that was to be performed on you. We owe our communities nothing less. Next time you have the chance to participate, sign up and see how much you've forgotten as well as how much you remember. And while you're at it, bring a friend!

Incidentally, here in Florida we have had a lot of practice with real emergencies, including flooding and tornadoes over the past few months. We've all heard people say that cellular phones have made us unnecessary in an emergency. Interestingly, when the landline phone system failed and people reached for their cellular phones they were unpleasantly surprised. I have heard many complaints that the cell system failed immediately after the wired phone system did and returned to service at about the same time—maybe we're not as obsolete as some would have us believe. 73

magazines is practically non-existent.

"I have called several places and searched all the sources I have and have pretty much struck out.

"I read your column in *73* faithfully (you have been at it a long time!).

"I would appreciate any thoughts you might have."

So then along comes another note, this one from Gerry Gore WB5TXA, who relates a search for test equipment, as well. Unable to find suitable materials, a Web site was born:

"Just a note to give you a URL to my home page, where I have gathered some neat tools for the RTTY ham using tones with their equipment.

"The programs use the sound card on a computer to measure and generate tones. The frequency counter and FFT scope do some neat things for RTTY. There are five separate instruments that are Freeware and all run on Win95.

"I couldn't find a site that had all of these in one place designed for the needs of RTTY, so I decided to make a page just for these types of items.

"I have enjoyed your RTTY Loop since you first started it many years ago. Keep up the good work!

"The URL is: [http//lonestar.texas.net/gore/ham_index.html]."

I checked the site out, and there are some very nice-looking software versions of well-known instruments. Take a look and see what you think. The price is right!

Regards to Larry N9LR, who is looking for a source for information on digital communication. Check out the home page for this column, the RTTY Loop Home Page, at [http://www2.ari.net/ajr/rtty/] for past columns as well as links to digital sites all over the World Wide Web. There is also a listing of software collections amassed over the last bunch of years, and available for a nominal amount to readers of this column.

Robert J. Furlong N4NHQ is a long-term reader who says he has "been reading your column since the beginning. I look forward to your comments each month. I had a Model 35 running back 15 years ago—boy, have things changed! But I think it has been for the good. Just wanted to let you know that your column is appreciated."

Well, Bob, I am not sure who appreciates whom more. Before we each break our arms, though, let me just interject that I sincerely appreciate the feedback from each and every one of you and, truthfully, without that feedback I could not bring myself to write this column.

Mentioned the old RTTY pictures a while back, and received a note from Chuck Swiger KB4NEW of Hampton, Virginia. He was surfing around and:

"Just found your Web site. Used to read the 'RTTY Loop' columns in *73*. Per the January 1998 column, I too would like to find some of the classic RTTY pictures to download or in an ASCII file format. Will hunt around the Internet for some.

"I'm planning on getting back on 20 meters RTTY sometime before the solar cycle peak (probably sooner, like this summer) with RITTY, which I'm using to monitor now, just need a powerful signal. It's my favorite mode, since I'm rather mike-shy and can't copy fast CW."

Thanks, Chuck. Somehow, somewhere, I just can't believe that some of those pictures are not out there on the 'net. We just have to find them! Let's all keep looking, OK?

I mentioned the RTTY Loop Home Page, and alluded to the RTTY Loop Software Collection, as well. Check it out and see the 17 or so disks full of RTTY, CW, and computer material available to you. If you cannot access the Web site, drop a self-addressed stamped envelope to me at the above address, and I'll be happy to send you a printed copy with full instructions.

More next time, as we've now begun the 22nd year of RTTY Loop! 73

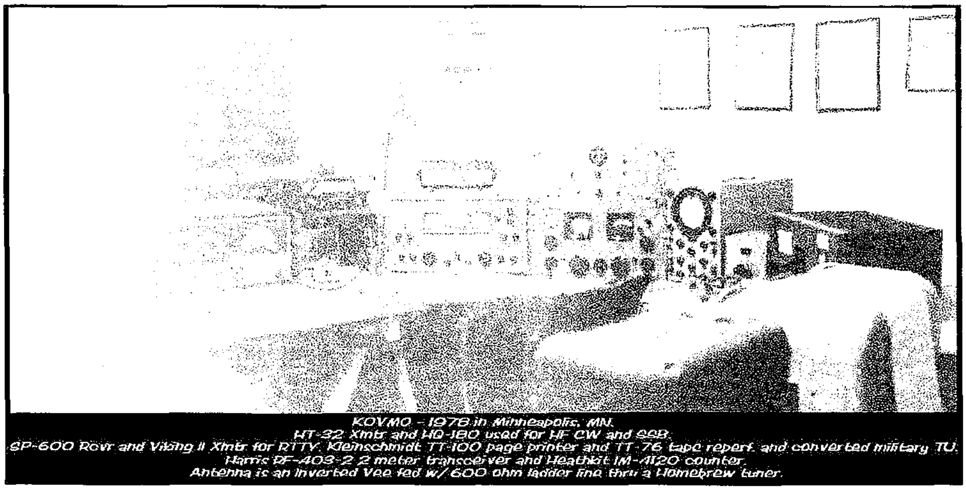


Fig. 1. Station KØVMO, Minneapolis, Minnesota (1978).

Number 58 on your Feedback card

Hamsats

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

A new book for new hamsats

When the American Radio Relay League published *The Satellite Experimenter's Handbook* by Martin Davidoff K2UBC in 1984, it brought many hamsat topics together in one publication. Finding information about working the satellites usually had been a real chore. Six years later, Martin updated the *Handbook*. New satellites were in orbit and computers had become a common tool for satellite tracking and other uses in many ham shacks.

In the ensuing years, digital modes and higher frequencies have become common. Martin has again rewritten many key parts of his book to reflect the changes in today's amateur satellites and to address some of the new and exciting possibilities of the next generation of low-earth-orbit and high-altitude satellites.

The new version is called *The Radio Amateur's Satellite Handbook*. It sports 370 pages of information and retails for $22. For those new to amateur radio satellites, the introductory section provides a nicely detailed

view of the program's history, starting from the perspective of *Sputnik 1*. Schematics of the first *Explorer*, *Vanguard*, and *OSCAR 1* beacon transmitters are included. The complete chronology of the OSCARs and the many volunteer hams who built them is fascinating.

For the experienced satellite enthusiast, the historical sections end with a look to the future. Brief descriptions of upcoming satellites, some of which are scheduled to launch this year, are provided. The list includes *Maelle* from France, *TechSAT* from Israel, *CESAR-1* from Chile, *HUTSAT* from Finland, *SUNSAT* from South Africa, *ASUSat* from Arizona, *PANSAT* from the Naval Postgraduate School, *Sapphire*, *Opal*, and others. One of the appendices includes Internet URLs (Universal Resource Locators) to help locate more data on the new satellites directly from the groups involved.

Following the history pages, Martin's revised offering continues with how to get started in the hamsat chase. In 1984, this was an easy topic. Analog reception and transmission on three bands was standard. Tracking was mostly done with polar maps and overlays, and antenna designs were not excessively difficult.

The new book asks the question, "Is satellite operation for you?" The playing field has changed. New modes, new frequencies, and incredible possibilities can confuse the newcomer. Martin describes five different types of hamsat activity, from the simplistic listener-only mode to the complex issues of high-speed digital operation. The long-time satellite chaser may also find the list of operating options useful. Trying new modes via low-earth-orbit satellites and digital operation via the packet hamsats can rejuvenate interest after years of DX-chasing via the high-orbit OSCARs.

The book continues with operating notes on satellite activities; information resources; and descriptions of international organizations, conferences, the AMSAT local area coordinators' network, satellite schedules, and the involvement of the ARRL. Various contests are conducted via satellite including AMSAT's own version of Field Day. Many awards are also available for satellite activity through AMSAT and other groups. Weekly AMSAT nets are held on HF, VHF, and UHF, and via commercial geosynchronous satellites. Martin describes many books and periodicals that can provide further insight and information.

Amateur radio satellites are not in geosynchronous orbits. They do not "hang" in the sky like the commercial TV satellites. They all have orbits that vary from circular to highly elliptic. The easiest way to find the hamsats is with a computer and appropriate software.

Martin describes how to find the hamsats using the tried and true graphical methods as well as by using computer software. He explains the data needed to keep tracking program calculations accurate. While a highly elliptical orbit may produce a very long period of signal acquisition, up to several hours, a low, circular orbit, like that of the *Mir* space station, may yield only short passes lasting 10 minutes or less. Accuracy and understanding are important. The "Tracking Basics" chapter starts with easy-to-understand explanations, while later chapters go into more detail on various satellite orbital possibilities and methods to automatically steer high-gain arrays for satellite communications.

The two final chapters of the book describe various satellite onboard systems, and what it takes to actually build a ham radio satellite. Topics include propulsion motors, power sources, onboard computers, radio links, thermal concerns, mechanical considerations, and launch opportunities.

There are several appendices complete with amateur spacecraft statistics including operating frequencies, manned space activity, spacecraft profiles, and computer program listings for simple hamsat tracking applications and other utilities. A very comprehensive description is included for the not-yet-launched Phase 3D. At this writing, negotiations continue between AMSAT and the European Space Agency for a ride to orbit for the largest, most complex hamsat yet.

The Radio Amateur's Satellite Handbook is more than just an update of the *Satellite Experimenter's Handbook*. It brings new hamsat information and operating practices together with an insight into the history of OSCAR and the possibilities for the future. A lot has happened since the previous handbook was published eight years ago. Copies can be obtained directly from the ARRL or through AMSAT for $22 plus shipping. AMSAT can be reached at (301) 589-6062.

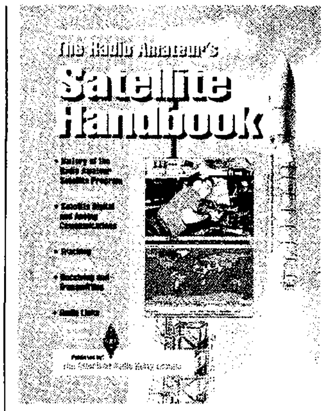


***Photo A.** Cover of* The Radio Amateur's Satellite Handbook *by Martin Davidoff K2UBC, from the American Radio Relay League*.

Field Day 1998

The ARRL Field Day is always scheduled for the fourth weekend in June. This year that occurs on June 27th and 28th. We have a few new low-earth-orbit satellites for extra points

Number 60 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Ham radio Salute to Gershwin

What in the world does ham radio have to do with the renowned composer George Gershwin? We who have been in the hobby for a while know that the influence and fun of radio can easily permeate many aspects of our lives. So it really didn't seem far-fetched to me to recommend the use of radio operators to assist a friend who was producing the 100th Anniversary Salute to Gershwin at Brooklyn College in Brooklyn, New York.

I'd been trying for months to expound on the benefits of radio communications to my good friend Jerry Parker, who is the former liaison to the Chancellor of the New York City Board of Education. The concert provided me with the perfect opportunity to demonstrate a practical application of ham radio from which he could benefit. Jerry worked very hard planning the logistics and details of this huge undertaking.

The concert on March 19th would feature groups from three Brooklyn schools: the Edward R. Murrow High School Orchestra, the Dyker Heights Intermediate School Chorus, and the Fort Hamilton High School Symphonic Band, all performing on the same program as the Brooklyn College Conservatory Jazz Ensemble. An event such as this involves a great deal of organization and effort. For months, I watched as Jerry coordinated everything with Dr. Nancy Hager, the Director of the Conservatory of Music at Brooklyn College and with David Latulippe, the Director of the Conservatory of Music Concert Office.

Finally, I knew the moment was right to suggest the incorporation of ham radio volunteers for communications and security. The idea was presented to the key personnel at the college, and everyone was very receptive.

Next, I announced the need for volunteers at a meeting of my radio club—NYCRA—the New York City Repeater Association. It's very gratifying to know that I can always count on getting a positive response when a call for help is put out. One of the people I know will always be the first to volunteer is my good friend Charles Hargrove N2NOV.

Charles is the ARES (Amateur Radio Emergency Service) Emergency Coordinator for Staten Island, New York. Staten Island is one of the five counties that make up New York City. When he was asked to organize an ARES unit in September of 1996, he read through accumulated materials gathered over his 20 years of interest in scanner listening of the public service bands. Charles thinks that since his uncles, cousins, and grandfather are and were police officers, it was natural for this interest to develop. Since March of 1992 he has been the moderator of the NYDXA Shortwave and Scanner Listeners Net heard locally on 147.360 MHz on Wednesdays at 8 p.m.

The team that Charles put together has developed into an efficient, active crew that has participated in walk-a-thons, parades, races, the New York City Marathon, the receiving of Mayor Giuliani's Proclamation of Amateur Radio Awareness Day, and now the Brooklyn College Salute to Gershwin concert.

I'd be remiss if I didn't mention every member of the group who provided such an excellent communications setup that night. The terrific ham radio operators who added a special dimension to the smooth operations were Charles Hargrove N2NOV; Karen Hargrove N2ZYF; Frank Katalenas N2UMC; Louise Pauly N2RIP; Paul Hansen N2QXB; Ray Valvik N2ZWT; Ron Faup KB2PWS; and Michael Moran KC2CYE. I had the honor of shadowing Jerry Parker, who quickly acclimated himself to the efficient use of the ham radios.

A radio volunteer was assigned to each of the holding rooms where the children waited until it was time for them to appear. The stage manager had his own shadow and was delighted to see how much of a help it was to him. Young Mike KC2CYE was assigned to the parking area, where he was a tremendous help. Days after the concert, the box office personnel were still talking about the valuable service provided by Karen K2ZYF and the other hams. Charles was net control and manned the crossband 2 m/440 base station. He happily shared information about ham radio with everyone backstage.

When the extraordinary maestro Laurence Laurenzano conducted the finale with the combined ensembles, all the volunteers were able to enjoy watching the wonderful performance from backstage. Paul Shelden, the talented director of the Brooklyn College Conservatory Jazz Ensemble, made a point of letting me know at the end of the evening that he was very impressed with the professional way the backstage communications were handled.

There were at least three people from the Performing Arts Center at the college who requested that I send them more information about getting a ham radio license. I always enjoy using my radio at different events, but this one was especially noteworthy for me because it involved children, the arts, friends, the community, and my very special ham friends. There was no doubt in anyone's mind that the hams provided an invaluable service.

For further information about ARES or emergency communications, call Charles at (212) 978-3375.

---

in the ARRL competition, or for the AMSAT (Radio Amateur Satellite Corporation) activity. The AMSAT rules last year worked well and will show little if any change for 1998. The first-place emergency power/portable station will receive a plaque at the AMSAT General Meeting and Space Symposium in Vicksburg, Mississippi, in October. Certificates will be awarded this year for second and third place. Stations submitting high, award-winning scores will be requested to submit dupe sheets for analog contacts and message listings for digital downloads. Check the AMSAT Web page at the URL [http://www.amsat.org] for details. The Field Day information is down a few levels under the "activities/amsatfd" subdirectories. The rules will also be published in the *AMSAT Journal*, or can be obtained by sending an SASE to me, W5ACM.

Number 61 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Bits and pieces for microwave and VHF

This month I would like to address some frequently asked questions concerning microwave hardware, such as: What do I need to pick up to start a microwave test bench? Which components of the test bench are most used for basic work? Also, I want to cover some simple test devices that can be constructed for both microwave and VHF operation.

A basic work bench for microwave should have some means of measuring power capable of displaying low levels of power. Here on microwave we talk of powers of -10 dBm and +15 dBm power. This is in difference of power on a VHF or UHF band where power can be measured in watts of power. Power in microwave is quite dear, in that higher levels of power are precious and expensive to obtain.

There is a direct comparison between power expressed in watts and dBm. It's not hard to remember a few simple facts to keep in mind when comparing the two power levels. For instance, two watts of power can be measured on a microwave power meter to a very fine accuracy, as long as appropriate attenuators are used. Most power meters for microwave are rated to +10 dBm maximum, so to measure two watts of power, which is the equivalent of +33 dBm of power, an attenuator is needed to reduce the power applied to the microwave power meter. It's just simpler to use dB vs. watts of power when making calculations. A simple rule to remember is: For every 3 dB of increase of power, you have doubled your original power in watts, or a portion of a watt.

As I stated, most microwave power meters are not capable of measuring power over +10 dBm maximum power or the sensitive power head will be destroyed. To allow the power head to work at much higher power levels, you insert precision attenuators in between the power source and the power head, reducing power to an acceptable level below the +10 dBm maximum. For instance, to measure a two-watt power source the level in dB would be +33 dBm. Inserting a 30 dB attenuator would reduce the power to 3 dBm, as read on the power meter, with the 30 dB being reduced in the attenuator. To obtain the true power measured, add the attenuator and the reading on the power meter (+3 dB) to obtain the true reading of +33 dBm.

Let's back up a moment. Remember, we said that +33 dBm was two watts, and as its power doubles, it increases 3 dB for each doubling of power. Therefore, 1 W = +30 dBm; then 2 W = +33; 4 W = +36; and 8 W = +39 dBm; 16 W = +42 dBm. Another good rule to remember is that 1 W = +30 dBm and 10 W = +40 dBm and 100 W = +50 dBm and so on.

To allow you to measure these power levels, you need a good attenuator capable of attenuating power and handling power dissipated in the attenuator, to make a power meter reading. If you wanted to measure a 10 W microwave transmitter or a similar VHF transmitter the method is the same: 10 W = +40 dBm, and the power meter is capable of +10 maximum. Therefore you must attenuate at least 30 dB, or, better still, 40 dB of power before hooking up to the power meter. Making a reading in this, you would combine the reading on the power meter (either negative or positive) in reference to zero dB on the meter to calculate final power observed.

Measuring 10 watts with a 40 dB attenuator, the power meter should read zero dBm, or 10 watts attenuated to zero dB by a 40 dB attenuator. Similarly, if you had used a 30 dB attenuator you would expect to read +10 on the power meter for the same 10 watts of power. While this will work, it is a bit risky, as it is the maximum power you should be absorbing in the power meter detector head.

A good set of attenuators to have on hand for making power

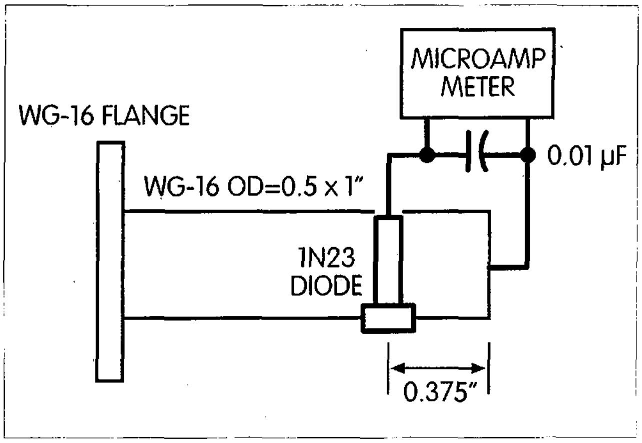


Fig. 1. Microwave Detector mount for 10 GHz showing detector diode spaced 1/4 guide wavelength from rear wall of detector mount. Can be home constructed from scrap waveguide and waveguide flange. Insulate top of 1N23 detector diode. Mount suitable meter very close to diode and bypass with .01 capacitor. For increased sensitivity, insert meter amplifier between diode and meter.

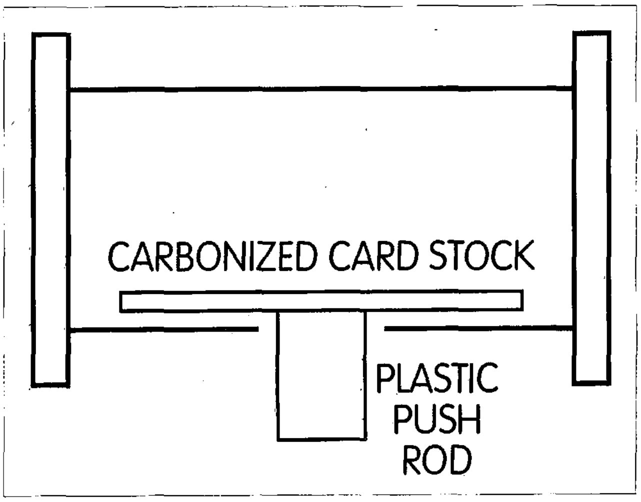


Fig. 2. Waveguide attenuator construction typical of both the fixed and variable types. The fixed can be useful but the variable waveguide types are much more desirable, especially small size variable attenuators. The waveguide attenuator is open on either end; as card is inserted toward center of guide, attenuation is increased. Attenuation is near zero when resting near bottom wall of WG.

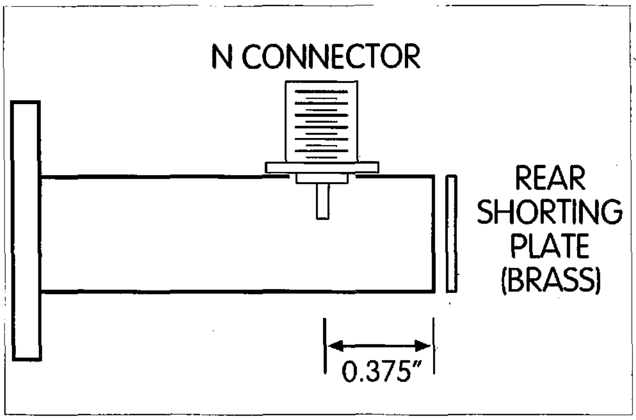


Fig. 3. Waveguide transition. Very similar to detector mount but uses probe from coax connector penetrating waveguide center to pick up microwave energy and convert it from waveguide to coaxial. Typically type "N" connectors are common. The connector is mounted on top of the side dimension of waveguide; drill hole to clear N coax connector flush with bottom of connector and waveguide. Space .375 inch from back of rear shorting brass plate. Solder all parts together.

measurements includes 3 dB, 6 dB, 10 dB, 20 dB and 30 dB. Normal microwave attenuators look much like a coaxial connector with a male connector on one end and a female connector on the other end. This is so that several can be put in series with each other and added together for total attenuation. For the basic types of attenuators two watts is normal. For increased power levels attenuators will have an additional heat sink or rings for power dissipation around the body of the attenuator. These types of attenuators are much larger and typical power dissipated can be 60 watts to 100 watts.

Another factor in attenuators is their internal structure that limits frequency response. Not all attenuators are created equal. Some attenuators in the two-watt range are good from DC to 12 or 18 GHz. Others are constructed in such a way they function well in the 2 to 4 GHz area but become unpredictable above these frequencies. The best idea is to read the label on any attenuator you want to pick up in surplus, and see if it will function at the frequency range you intend to use it at. The golden rule is "If it's expensive and unmarked, check it out *very* carefully before purchasing." Don't buy something you can't use.

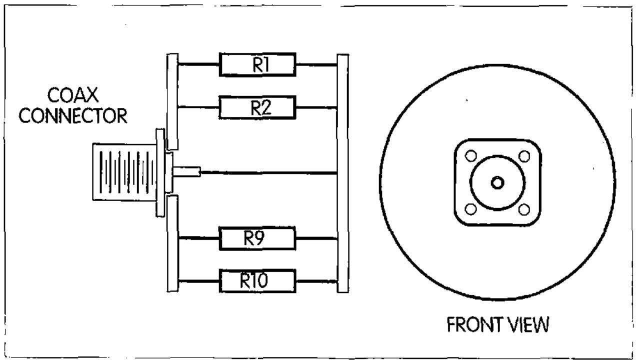


Fig. 4. Dummy load construction showing means of construction for VHF operation from multiple resistors equaling 50 ohms or nearly 50 ohms, placed between two brass or copper plates. The hole in the center of the top disk is for coax connector. Solder to top plate; center conductor of connector is soldered to bottom plate. Unit can be inserted into a small can for shielding after construction.

One way to test to see if an attenuator is alive is to carry an inexpensive VOM in your pocket. A lot of attenuators sold are destroyed by applying over-power to them, cooking the resistors inside. Check to see if you have a DC resistance from input to output on the center pin. Readings should be in the low-to-modest 100 or so ohms. Then check from each end's center pin to case ground. The readings on each end should be similar, and again, in the low-to-modest 100 ohm ranges. For example, a typical "T" type attenuator would measure 50 ohms from input to output and 61 ohms from each end to ground.

Waveguide devices

The most useful waveguide devices that an amateur can use are threefold: a detector mount, a transition, and a variable waveguide attenuator. These devices need be considered only if you intend to work with waveguide. Some devices that can use waveguide fixtures are traveling wave amplifier tubes (high power at microwave), Gunn diode units for wideband FM on 10 GHz and most bench test equipment associated with waveguide fixtures.

The most important item to obtain for waveguide use is the transition that converts a waveguide flange connection to a coaxial connector. This allows interweaving with waveguide in certain pieces of equipment you might have and coaxial connections in the rest of the equipment. Typical useful interconnections are antenna feeds, like waveguide horns, and other antenna hardware.

In this testing arena, a good waveguide detector mount can be put to use on a remote antenna such as a horn or other broadband device. In practice, horn and detector mount are cabled back to a testing site some 100 to 200 feet in front of the test antenna and detector for indication at the transmit site. Now, you have a simple part of an antenna test range to show dish aiming and a relative gain measurement. It's a good idea to try simple tests and methods to find out how well systems are functioning, using such equipment.

Waveguide attenuators, especially variable attenuators, can prove useful by reducing a signal at the source, to see how far a signal can be reduced before you can no longer copy it, giving some means of finding minimum signal level of detection, another method of comparison to try out using simple equipment.

Waveguide and coaxial attenuators work the same, but in different styles and package forms. The principle is the same in either domain. In a coaxial domain the ends of a connector can be soldered to common small composition resistors, duplicating the values needed for a similar attenuator type. These will function well as an attenuator, but at a very reduced frequency before they become unreliable. The problem with this type of construction is that it's OK for six or two meters, and *might* work at 450 MHz as well, but as the component size starts to become a part of a wavelength at the intended frequency of operation, the performance falls apart very fast.

Components' size and physical construction techniques need to be quite special if they are to function with accuracy at frequencies above several GHz, let alone function to 18 GHz. Normally the resistors used in commercial attenuators suitable for high GHz work are constructed with special-shaped cores and have the resistance material deposited on them. The combination of shape and deposited resistance material give the very special characteristics (low SWR) at microwave frequencies.

Attenuators of the waveguide type are constructed with a card inserted in the narrow side of a waveguide and have deposited resistance material on one side of this card material. It can be thought of as being cardboard with graphite on one side of the card for a mental picture. When the card is adjusted to minimum attenuation the card rests against the short side wall of the waveguide. As the adjustment arm is changed in length to more attenuation the card is pushed out from the side wall into the waveguide towards the center of the guide. As the attenuator is pushed or adjusted towards the center of the waveguide the attenuation increases rapidly.

Transmission of RF in a waveguide results in the most RF signal at the center of the waveguide. So anything inserted into the waveguide at this point will intercept a great deal of the applied RF, reducing the output of the system after the attenuator.

50 Ω dummy load

Home construction of attenuators and detector and transition mounts is possible. However, in the case of attenuators, special techniques are needed, allowing good operation in the very high microwave frequency ranges. Home construction is not recommended. I stated before that attenuators and dummy loads can be constructed from common carbon resistors. While it's hard to find an exact 50 Ω resistor, several higher-value resistors can be placed in parallel to obtain a value of near 50 Ω.

Simple 50 Ω dummy loads (terminations) can be easily constructed from a large number of high-value 1 or 2 W carbon resistors. Let's say, for instance, if you want a 50 Ω 10 W load for two meters. Calculate: If you had 10 each one-watt 500 Ω resistors, placing them all in parallel with each other, you would have exactly 50 Ω with a power dissipation of 10 x 1 W ... exactly what you wanted.

In the real world things are not all that neat. But calculate with a standard value like 680 Ω (one watt) by placing 10 in parallel. That would be 68 Ω; 14 resistors result in 48.5 Ω, and 13 resistors result in 52.3 Ω. See how simple it can be to come up with a 50 Ω dummy load for test?

To find out if you have suitable resistors to total the correct value for a 50 Ω load, just divide the value of resistors by the quantity of resistors. An easier method is to take a value you have on hand and divide it by the value you wish to arrive at, and the result is the number of resistors in parallel needed. (Example: 750 Ω stock resistors divided by 50 Ω desired = 15, the quantity needed in parallel to obtain a 50 Ω final product.)

Waveguide transition

Now what about the transition mount for waveguide that I mentioned earlier? All it needs to be is a short section of waveguide, about an inch long, with a coaxial connector mounted on top of the wide face of the waveguide. Usually a type "N" connector is used to be the coaxial interface to the waveguide. It is mounted on the wide side of the waveguide centered on the broad face of this side. The center connector (solder terminal) is extended into the hole in the waveguide and into the inside of the guide. This pin (center of coax connector) is spaced 1/4 guide wavelength from the closed end of the rear wall of the waveguide. This dimension is approximately .375 inches for 10 GHz operation.

A guide wavelength is similar to figuring a wavelength in coaxial cable, when its length is corrected by the velocity factor of coaxial cable. Just for the record, a guide wavelength (Xg) is equal to 1.5 inches for 10250 MHz making 1/4 Xg equal to .375 inches. Now, if you use an "N" connector it can be placed on the waveguide wide dimension with its flange just extended over the rear of the guide equal to the thickness of the flange. When the shorting plate is attached to the rear wall under the connector's flange it makes for a flush mounting.

Both the detector mount and the transition are constructed quite similar in that the active element is spaced 1/4 guide wavelength from the end of the rear wall of the waveguide. Shown in **Fig. 1** is a simple detector mount that has the cartridge-type diode (1N23-type) inserted from the bottom of the waveguide (grounded to WG at this point). The top of the diode passes through the top of the WG through a small hole, and is built up with insulating material just below and on top of the diode, like cellophane tape washers over the diode's pin. The pin is insulated from touching the sides of the hole and connection is made to the pin with as short a connection of coax cable to the meter as possible, which is bypassed for RF with a .01 capacitor. An amplifier can be used for improved sensitivity by connecting it between the meter and the diode. Normally this type of detector is used on wavemeters and similar-type devices for indicating a relative RF measurement. Construction methods are not critical.

Next month I want to present some items you can put together in your garage that are useful in demonstrating RF transmission on a simple antenna test range. I will get into how SWR is measured at microwave compared to VHF and describe some test and measurement equipment used in these tests. 73 for now, Chuck WB6IGP. 73

Number 63 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Avenue SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Ham radio takes to the fields and back woods this month as Field Day once more brings the hams out of the woodwork. If you've never operated Field Day running QRP, you're in for quite a thrill!

A QRP Field Day

Perhaps one of the best things going for a QRP Field Day is the ability to carry everything you need in a backpack! Here's a list of the things I take with me for QRPing in the field:

- A QRP rig. I like a multiband rig that covers at least the 40 and 20 meter bands. If possible, 80 meters comes in real handy for late-night contacts.
- An 18 amp/hr gelled lead-acid battery—fully charged, of course. One of my expanded analog voltmeters to monitor the battery's voltage goes in the Field Day kit, too.
- To keep the battery topped up before the 2 p.m. start time, a 10-watt Solarex Lite™ solar panel and a Micro "M" charge controller finish out the power system.
- There are only two antenna choices I will ever use for Field Day. One is the G5RV multiband dipole; the other, a random-length wire. To use either one, an antenna tuner will be needed. The antenna should be ready to go on site. You don't want to waste time assembling an antenna when you could be drinking Diet Coke® and munching on Oreo® cookies! Of course, you'll need some support rope and perhaps an extra antenna insulator or two, just in case.

Continued on page 74

Tips from a QSL Guru

Here's how to make your card count.

Bob Shrader W6BNB
1911 Barnett Valley Road
Sebastopol CA 95472
[w6bnb@aol.com]

Have you ever thought about how another amateur receiving one of your QSL cards might feel about it, and about its sender? With 68 years of hamming and QSLing behind me, here are some ideas I have picked up about QSL cards. Only cards printed on one side will be discussed at any length.

(Double-sided cards may have only the callsign, a picture or cartoon, and the operator's name and address on the front side, while the back side will usually have blanks for the details of the QSO—the date, RST report, station information, and signature of the sender printed on the left side, possibly with blank lines for the address of the person to whom the card is being sent on the right side.)

When you only want to confirm a contact made with some station, as with many DX contacts, any minimal form of a card will do. But, if you would like to project an image of friendliness after an interesting QSO, then it would be better if your card were more detailed.

A minimal type of QSL card should have your call letters standing out, in fairly large print, either across the top or at least very near the top of the card. Bright colors are beneficial. In many cases, particularly with beginning amateurs, ham shack walls become resplendent with mounted cards from all over the world. They do make an impressive display for visitors! Call letters that can be easily read from a distance are most desirable. Where the call letters are placed on cards that are wall-mounted is probably not too important. But after a time there may be too many received cards to wall-mount all of them. From then on, received QSLs will usually be filed in one or more drawers or boxes. Whether filed by country, by area number, or by whatever filing system is decided upon, they'll still usually be standing up in their filing container. Unfortunately, if cards are not wall-mounted, in many cases they may rarely be seen again. So how much should you spend for QSL cards? Good question. The single-sided cards discussed here are usually the least expensive.

Filing concerns

No matter what your filing system, it will usually require considerable time fingering through the cards already in the file to find where newly received QSL cards should be inserted. If the call letters on your filed cards are not shown at, or very near the top of the card, you will have to dig down in between your already filed cards to see what the call letters are of the cards between which the new one is to be inserted. If cards are of different heights, this can be a tedious process. When call letters are printed too low on received cards, in many cases I have hand-printed the call letters of these cards on their top margin with a felt pen so I could see more easily what the card's call letters are. That spoils what otherwise might have been a nice-looking reminder of a past contact. Fortunately, call letters across the narrow dimensions of the card are not too popular.

If a card varies very much from the standard postcard size of five and a half inches horizontally by three and a half inches vertically (14 by 9 cm), it will not fit well into the usual filing container. If it sticks up too high or is too short in the file, it can make finding where a new card should go unnecessarily difficult. I have trimmed off excessively high and/or wide cards

and thereby lost information on them. I have even dumped some of them because they were too tall, too short, too small, or too wide to fit into my filing drawer. Furthermore, odd-sized cards may not mount too well alongside standard-sized cards in a wall exhibit.

Minimal info

On a minimal QSL, the most important information besides the call letters is the operator's name and postal address (street, number, city or town, postal or ZIP code, and country). Print the name and address as it should be shown on any return QSL. Since there is no telling for what reason the other amateur is collecting QSLs, you may want to add your county or other geographical designation, perhaps your grid square, and I have even seen a few latitudes and longitudes on cards. Other information to show on minimal cards is the frequency or band used, and a truthful RST report, not the meaningless "599" given for so many actual "349" or worse DX contacts. If there is anything improper sounding about the received signal, such as hum or distortion, the third number should never be a "9." If you note drifting, chirping, hum, distortion of any type, indicate it with an "8," "7," etc. Such information should be appreciated by the other operator, telling him or her that something should be corrected. At the bottom of the card there should be a "73" and a line on which to sign your name. Minimal cards are to be expected from DX hunters or expeditions. These people are just too rushed when filling out their dozens to thousands of cards to enter anything but the barest essentials.

Smile

A more friendly and informative QSL card will have all of the information of the minimal card plus some additional little niceties. Examples of a possible single-sided QSL card are shown in the illustrations. The "To" is for the other operator's name. After "RST," if fading was bad, the report might be shown as "4 3/8 9." Be sure to have plenty of space on the Rig,

W6BNB

Robert "Bob" Shrader, 11911 Barnett Valley Rd, Sebastopol, CA 95472, USA
Sonoma County • Grid Square CM88 • E-mail address: w6bnb@aol.com

To .... of station .... ur .... MHz .... mode sigs rcvd
here RST .... at .... Pacific time (+8 hrs = UTC) Date /Mo. /Day /Yr.
Rig in use was a .... running .... W_o
Amplifier .... not/was used/capable of/at .... W_o
Antenna .... Remarks ....
....
Pse/Tks QSL With .... de .... Licensed 1931

Licenses held: Amateur Extra Class - First Radiotelegraph - First Radiotelephone
Member of: $SOWP_{SGP}$ - ARRL - OOTC - QCWA - CFO - SIRARC - SARO
Author of: Electronic Communication - Amateur Radio Theory and Practice
Fire Fighting, How It's Done And How YOU May Have To Do It

***Fig. 1.** The author says his XYL prefers the callsign-across-the-top style.*

Amplifier, Antenna, and Remarks lines. If you underline the "Pse" of the "Pse/Tks" it is asking for a QSL and thanking the other operator for it at the same time. But be sure to cross out the "Pse" if you are sending an answering card. After "Amplifier," if not using your amplifier during the QSO in question, cross out the "was." If the amplifier was used, cross out the "not." If you use no amplifier this line would not be required. If you do not expect to change your equipment for several years, you can have the equipment type, the power output, and the antenna used printed on your cards. However, if you ever change from your regular operating power to QRP, or change the equipment being used, this would not be allowed for on the card. Also, if you use different equipment for different bands or uses, printed data on the card may not be such a good idea.

Note that I like to use my local time. This tells the other operator what time of day it was at my QTH when his or her signals came through on the band specified. To indicate what the UTC was, add the "(+8 hrs = UTC)," using whatever time difference is appropriate for your area. This also gives the

W6BNB

Robert "Bob" Shrader
11911 Barnett Valley Road
Sebastopol, CA, 95472, USA
Sonoma County. Grid Square CM88
e-mail address: w6bnb@aol.com

To .... of station .... ur .... MHz .... mode sigs
rcvd RST .... at .... Pacific time (+8 hrs = UTC) Date /Mo. /Day /Yr.
Rig used was .... with .... W_o
Amplifier .... not/was used/capable of/at .... W_o
Antenna .... Remarks ....
....
Pse/Tks QSL With .... de .... Licensed 1931

Licenses held: Amateur Extra Class - First Radiotelegraph - First Radiotelephone
Member of: $SOWP_{SGP}$ - ARRL - OOTC - QCWA - CFO - SIRARC - SARO
Author of: Electronic Communication - Amateur Radio Theory and Practice -
Fire Fighting, How It's Done And How YOU May Have To Do It

***Fig. 2.** Callsign at top left is also an option.*

receiving operator a rough idea of the longitudinal distance between your two stations. I rarely take the time to figure out what the local time of day was for a UTC time shown on a QSL card, although knowing it might be of interest in many cases. Obviously, if you like UTC, it can be used instead of your local time. However, I prefer to operate according to my own local clock and not by clocks on longitudes similar to that of Greenwich, England.

Signal reports

Probably the items of most interest to the other operator, besides your geographical location, will be your transmitter's power output and the type of antenna you were using. It allows a comparison to be made with his or her own equipment operation determined by the received RST report and the report you give on a return QSL. Unfortunately, with most rigs, S-meter readings may be fairly accurate only on a couple of bands, due to antennas being used and other variables.

S-meters are rarely accurate on most bands. (If I gave actual meter readings of weak but readable signals according to my transceiver's S-meter, on the higher frequency bands they would all be RST 509 and the other operators would be very unhappy.) We should learn to assess S-units by ear, as was done in "the good old days" when receivers had no S-meters! Basically, with equal power being radiated by two stations, the S-meter reports should be almost identical. If both are using 100 W_o and one station's report is S9 but the other's is S6, something is wrong—probably one or both S-meters! Of course, if you do not keep a log, no true return RST reports will be possible. (I prefer three-inch by five-inch card files, using typing paper cut to the desired dimensions instead of cards.)

Who made the equipment that produced the RF power output specified may be of interest, particularly if home-brew or vacuum-tube equipment is involved. In the latter cases, describing the type of oscillator being used and the final amplifier stage details can be interesting items. If the RF power output of a home-brew rig is not known, it will usually be pretty close to half of the DC power input (where P_{in} = I x E, using the DC current fed to the final amplifier device, I_p for tubes, I_c for transistors, times the final amplifier DC voltage, E_p for tubes, V_c for transistors). If you know the class to which the final amplifier is biased, ballpark figures might be about 40% for class A, 50% for class B, and 60% for class C. For example, with a DC input of 140 W_{in} and using a class A final amplifier (to produce the lowest harmonic signal output, and minimal TVI), the RF output would be roughly 140 x 0.40, or about 56 W_o. Details of home-brew receivers, antennas, and antenna tuners are also of interest to other amateurs, particularly those who do or have ever done any radio construction work themselves.

Remember 2000

Note that the year has been left off. This allows the year number to be filled in. The year 2000 is not too far away! It is going to give us enough grief with our computers, etc., without adding 199_ to any QSLs we order now.

Personal touches

Cartoons, or pictures of the operator or his equipment, may add interest to a QSL card. If used, though, it is questionable if they should be the dominant item on the card (unless a double-sided card is used). It must be remembered that the most important feature of any QSL card is really the callsign on it. The callsign should not only stand out, but, as mentioned before, should be printed near the top of the card for easy filing. That callsign is important because it can be rightfully claimed by only one person in the world, the operator who is sending the card (club stations and DXpeditions excepted).

At the bottom of the card, you might add something about yourself that might be of interest to the other operator. For example, you can indicate what amateur or other license(s) you have, such as a pilot's or other license(s); the names of amateur or other radio organizations to which you belong (possibly with a printout of their symbols); when you were first licensed and under what call if different from your present one; your E-mail address; and amateur awards you have won. You may be able to include other things about yourself that would be interesting. I list the names of some of the books I have written, as shown.

When you start working a station, check your QSL file to see if you have a card from him or her. If you do and it is properly filled out, the information listed on it may be useful in making the present QSO a lot more interesting. Use the blank left half of the address side of a single-sided QSL card to add any additional information that you might want to give the other operator. It will usually relate to something that was discussed during the QSO.

Remember that any first, good, informative, and interesting QSO, and particularly if it is a DX one, deserves a good, informative, interesting to read, QSL card. One nice thing about more informative QSL cards is that they will almost always result in a return card, which is sometimes hard to get from some DX stations! Remember these suggestions when you are making out your next QSL card order! (No, I am *not* in the QSL business—but QSL card printers might take note.)

Roamin' Romania

Part 1: Timisoara, home of the revolution.

George Pataki WB2AQC
84-47 Kendrick Place
Jamaica NY 11432

In the fall of 1997, I decided to visit, probably for the last time, the city where I was born a long, long time ago. I wanted to meet my radio amateur friends and see how they were coping under the new socio-political system, almost a decade after a bloody revolution that freed them from dictatorship.

I flew with *TAROM*, the Romanian airline, the only nonstop flight from New York City to my home town of Timisoara, and in about eight and half hours I arrived at my destination.

The flight was boring, with two dull movies and two flat, airline-type meals. (On my return, I saw exactly the same two boring movies, and I think they served me the same meal I did not eat the first time around … like my mother used to do. What I did not eat for lunch, I got for supper.)

At Romanian customs, I was asked the routine question:

"Do you have any electronic gear?"

The obvious answer was "No," even with my suitcases full of various things for radios and computers—gifts for hams. The customs officer stretched his long hand under layers of clothing I had brought for relatives, and pulled out a low-pass filter.

"What is this?"

"Is something for a big car," I said, giving the proper answer under the circumstances. The customs officer probed even more deeply into my suitcase. I silently placed a curse on his fingers, and he pulled out a high-pass filter.

"What is *this?*" he inquired again, with the inquisitiveness of a man in uniform.

"Is something for a *little* car." I helped him satisfy his curiosity.

Convinced that I had nothing "electronic," he let me pass.

I even had a heavy box with 100 amateur radio magazines in it. I had no problem with them, except in carrying the box. In New York, I had tied the box with a long and very thick nylon rope, but the box arrived in Romania

Photo A. *Dan YO2LLQ (front) and Sorin YO2LLL at the Children's Palace Radio Club Station YO2KAC in Timisoara.*

without it—one of the many mysteries of flying a commercial airline.

In the city of Timisoara, I went to see the club station that I had established back in 1955 at the Children's Palace. Now the teacher and chief operator is Szigy YO2IS. Operators are high school students like Sorin YO2LLL, Dan YO2LLQ, Cristi YO2LOM, and Bobby YO2LIF (**Photo A**). The station is a modest FT-250 with an all-band wire dipole. Now they have a much smaller room than I had there 40 years ago, and the available funds have shrunk a lot. Nevertheless, the operators work with enthusiasm, build various gadgets, make QSOs, and send QSL cards. Some of them even have personal homemade stations.

Next to see was club station YO2KJO of the High School for Telecommunications. There the chief is Norby YO2LGU, a student at the Technical University (**Photo B**). Norby, licensed in 1991, is the sysop for the YO2KJO BBS.

I also visited Bata YO2LAM, licensed in 1982, a petrochemist by training but presently running a furniture store (**Photo C**). Bata just moved into his new house, all white marble, inside and outside, with a special radio room equipped with an FT-1000MP transceiver, an FL-2277B linear, and a Drake antenna tuner. It seems there is a lot of money in selling beds and mattresses. In a backyard cottage, I saw a roomful of large, obsolete Russian military transceivers. On a 50-foot tower, Bata has a TH11DX, a 16-element horizontally polarized yagi for two meters, and a wire dipole for 40–80 meters. On a separate mast installed on the house, he has a five-element yagi for six meters, a 22-element yagi for 70 cm, and a vertical for two meters. Bata YO2LAM is an occasional contester, a DXer, a good QSLer, and an all-around nice guy.

I saw the stations of Szigy YO2IS and his wife Delia YO2DM, quite a famous couple in amateur radio (**Photo D**). Szigy is a teacher. He is running the YO2KAC club station at the Children's Palace but his claim to fame is his prestigious EME activity. Under very difficult conditions, having only a narrow opening between large buildings for his EME antennas, Szigy YO2IS managed to make over 538 EME QSOs on 70 cm, with 33 countries, 138 different stations on five continents, using about 600 watts. On two

Photo B. *Norby YO2LGU at the Telecommunications High School's Radio Club Station YO2KJO, also in Timisoara.*

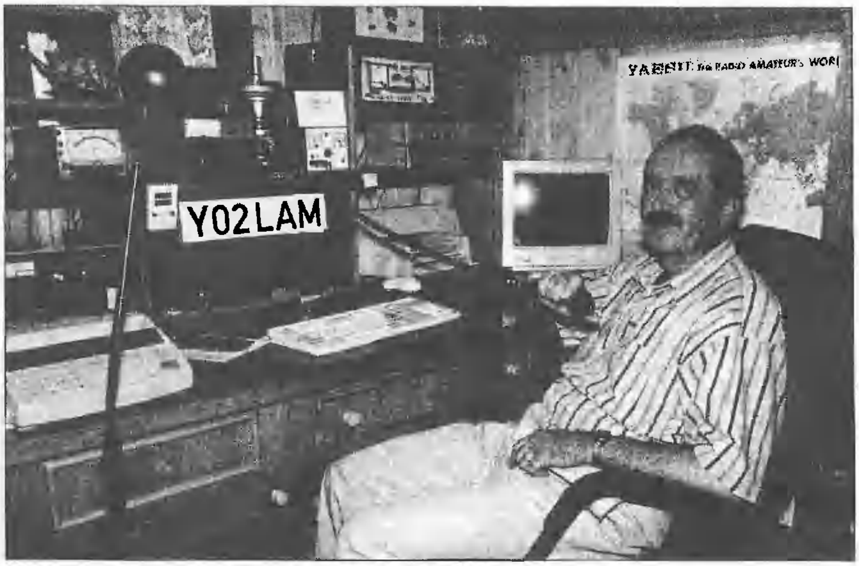


Photo C. *Bata YO2LAM, "all-around nice guy."*

Photo D. Delia YO2DM and her husband, famous EME-er Szigy YO2IS, show off their completely *home-brew shack.*

meters EME he made 26 contacts with five countries, 16 different stations, using 1 kW. Everything in his shack is homemade—and he has quite a lot in it.

Delia YO2DM has a full-time job as the chief of the Timis County Radio Club, YO2KAB. She has her own setup, works in contests, is a DXer, and is a reliable QSLer.

Poly YO2BX, licensed in 1956 and a retired engineer, is an old friend of mine (**Photo E**). He is using a modest HW-101, pushing 80 watts to a five-band Windom antenna. Poly is a builder and experimenter, operates only SSB, occasionally works DX, and *does* QSL.

Vivi YO2AFS, licensed in 1964, is an electrical engineer. He is a master builder, and his radio room is full of his projects. He does not have too much space in his own cramped apartment, so for many years, every day after finishing his work at the factory he has gone to his daughter's house. There is his radio shack, where he tinkers for hours before he goes home. Vivi has a vertical for two meters and was in the process of installing his new, all-band G5RV antenna. He

Photo E. Retired engineer Poly YO2BX has been licensed for more than 40 years.

Wanted

Fun, easy-to-build projects for publication in 73.
For more info,
write to:
Joyce Sawtelle
73 Amateur Radio Today,
70 Route 202 North,
Peterborough NH 03458

***Photo F.** Near Buzias, Vivi YO2AFS (left) and Liviu YO2BCT set up a 432 MHz antenna for an IARU contest.*

works in contests, participates in fox hunts, and has QSL cards.

I went with Vivi YO2AFS and Liviu YO2BCT on an outing about 20 miles from Timisoara, when they worked on 70 cm in an IARU contest (**Photo F**). We could not drive to the intended location on the top of a hill because of the bad roads, so we went halfway up, to about 650 feet. There we installed an array of four long 16-element yagis, and Vivi and Liviu operated as long as the band was open, making 30 QSOs. When there was no propagation we tried to sleep in cars, but it was quite chilly. At least it did not rain.

We passed some of the time with a little YO ham humor, which I am happy to bring back for you in the form of these pieces of advice for people working DX:

•*If you are calling "CQ DX" and a nearby ham is answering, ask him to call you again on the long path.*

•*If a DX station does not answer you, imitate his accent and he will pick you from the pileup.*

•*If a DX station does not answer you, call him with a high pitched voice; he'll think you are a YL and will answer right away.*

•*If you cannot get through a pileup, turn on your super big amplifier and yell "QRP, QRP!"*

•*If you worked a DX station six times, and he always promised QSLs, and you sent cards every time but received nothing, perhaps it is time to doubt his honesty.*

•*If a DX station is asking for more money for his QSL than is required for postage, he is just trying to make a "decent" living.*

•*If you send a DX station your QSL with a couple of green stamps for postage, and he answers you years later via the bureau, be thankful—but put a Gypsy curse on his head.*

•*If a DX station is working "split" and you keep calling him on his frequency, consider changing your name to "Lid"—everybody else is already calling you that.*

***Photo G.** Boby YO2AAG designed and built most of his equipment himself.*

Let me continue with my trip. Boby YO2AAG is also an old friend of mine (**Photo G**). Licensed in 1963, he is an electronic technician at the local power plant. Boby is a master builder. Most of his equipment and antennas were designed and made by himself. He is running 180 watts and has a very tall tower decorated with scores of antennas, including a W3DZZ for 40 and 80 meters. For two meters, there's a 15-element vertically polarized yagi for repeaters; an 11-element horizontally polarized yagi for DX; and a vertical Ringo Ranger. For 70 cm, he is using a 30-element vertically polarized DJ9BW-type yagi, and another antenna similar but horizontally polarized. Also on the tower, in boxes, are two power amplifiers for two meters and 70 cm. And as if these were not enough, there are two large parabolic antennas for satellite TV. Boby YO2AAG has worked over 130 DX countries, 25 of them on two meters. He does QSL.

Karoly YO2GL, licensed in 1961, is an electronics technician (**Photo H**). He maintains test instruments for the local medium-wave broadcast transmitters. His shack is above the 10th floor of his apartment building, where the elevator motor and its control panel are located. He has direct access to a large flat roof where he can experiment with his antennas. This is the good news—the bad news is that the very strong electromagnetic fields from the nearby huge transmitting tower antennas interfere with everything.

Karoly is a contester, having worked over 130 countries, but he is mostly a builder. He has a G5RV for 10–15–20 meters, as well as a dipole for 40 meters and another one for 80 meters— both strung between two tall buildings at about 165 feet above the ground. For six meters, Karoly has a two-element quad; for two meters, he is using a 16-element rotatable, horizontally polarized yagi and two connected nine-element vertically polarized yagis.

I don't remember if it was Karoly who told me this one:

There was an amateur who wanted to buy a transceiver, agreed on a price, and told the merchant:

Photo H. Karoly YO2GL's rooftop antennas face constant interference from the large broadcast towers in the background.

"My most respected dealer, if you trust me I'll pay you in about six months. When can I pick it up?"

"My most respected customer," answered the dealer, "of course I trust you. In about six months."

The county radio club located in the center of Timisoara has two rooms: one with a nice station (YO2KAB) and a QSL bureau, and a small meeting room. The chief of the club is Delia YO2DM, and its president is Zoli YO2BP, a very active ham. The station is modest and they use a longwire strung across the street to a tall building.

At the club, I met up with several amateurs (**Photo I**): Aurel YO2BS, Romi YO2AEG, Noni YO2DNO, Valy YO2AQO, Sorin YO2LLL, Dan YO2LLQ, Szigy YO2IS, and Calin YO2LOG, a reporter who interviewed me for his paper. In that article, I blasted the politicians who don't know anything about the services brought to society by amateur radio operators, and don't allocate funds to adequately support this valuable activity.

I had a good time in Timisoara. I visited old friends and made new ones. I went twice to the opera, where I saw a very good *Rigoletto* and a so-so *Cavaleria Rusticana*. The best seat in the house cost me about three dollars. Twice I went to the theater. Both plays were good, and tickets for the first-row seats were two dollars.

I bought a bunch of books written by survivors of the labor camps and extermination prisons of the communist era. I talked with participants in Timisoara's popular uprising of December 1989, which became the revolution that liberated the country. Many people participated in the revolution, and afterwards even more people *claimed* that they had participated. As one revolutionary said: "Few we were, many we remained."

From Timisoara, I took a side trip to the valley of the Jiu River, a rich mining region. In the Jiu Valley I met many amateurs, but that will be the subject of Part 2.

In conclusion, please allow me to straighten out some questions. A rumor is circulating in Romania that I am the governor of the State of New York; that I was the mayor in a city in the same state; that I became a rich and famous attorney; that I made lots of money in the stock market; that my grandfather came from Hungary; and that I am a nice and helpful guy.

To all my YO friends, please note: I am not the governor of New York State. I have never been a mayor in any town. I am neither rich nor a famous attorney. I did not make any money in the stock market—rather, I lost some. My grandfather has never been in Hungary. And, instead of being nice and helpful, I am mean and nasty. Other than these discrepancies, the rumors are fairly accurate.

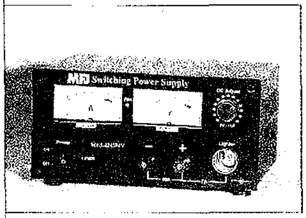
On the day I returned to New York, my friend Bata YO2LAM and Sandu YO2LIZ, a firefighter, came to the airport to say good-bye (and probably to make sure that I was leaving). I think I asked the local hams too many questions. And I tried repeatedly, often in vain, to make them smile for the camera. It will take time, but this nation will one day smile again. 73

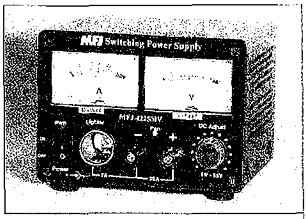
*Photo I. Sorin YO2LLL (**Photo A**) makes it to another club station, this time joining Valy YO2AQO at Timis County Radio Club Station YO2KAB (in Timisoara).*

Number 72 on your Feedback card

New Products

Switching Power Supplies In Your Hand!





MFJ's *MightyLite*™ switching power supplies are super-light and compact—the MFJ-4225MV 25-amp weighs just over three and a half pounds, and the 45-amp version, MFJ-4245MV, weighs a mere five and a half pounds. That's a whopping *eight times* lighter than a comparable non-switching power supply!

These new switching power supplies feature a front-panel voltage control that lets you vary the output voltage from 9 to 15 VDC and gives a highly regulated output. You get less than 35 mV of peak-to-peak ripple under a 25- or 45-amp full load. Load regulation is better than 1.5% under a full load—and there's no hash! You won't hear noise in your signal, and neither will the guy on the other end.

Both models are cooled with a whisper-quiet internal fan, and are fully protected from overvoltage and overcurrent. It's a long-term value, for an investment of only $149.95 (MFJ-4225MV) or $199.95 (MFJ-4245MV), and of course it comes with MFJ's famous No Matter What™ one-year limited warranty.

For more information or to order, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or check out dealer and ordering information on the Web site at [http://www.mfjenterprises.com].

Alinco Goes Public

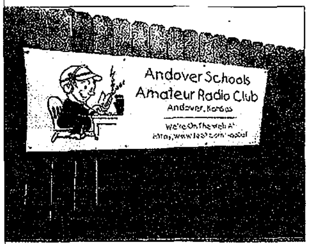
The DJ-S46 is the first product Alinco has released in the US that is intended for use by the general public. It's a handheld transceiver designed to operate on the Family Radio Service (FRS) band. About the size of a beeper, the new DJ-S46 has been type-accepted by the FCC. It features all 14 FRS channels and, using AA batteries, transmits with an output power of 340 milliwatts. The DJ-S46 puts two-way radio within the reach of anyone who needs quality communications in a relatively small area—think of the possibilities for farms, ranches, vacations, camping, shopping ... when you last took the kids to a mall or a theme park, did you know where they were every second?

See your Alinco dealer for more details about the options and other features of the new DJ-S46.

Russki Keyski

Soviet engineering didn't disappear with the fall of the iron curtain. ElectroInstrument, a former Soviet military contractor, is now producing the ElectroInstrument Key-8 paddle keyer, which is available in the US through Milestone Technologies, 3140 S. Peoria Street, Unit K-156, Aurora CO 80014-3155. President Marshall Emm of Milestone is thrilled with the Key-8, calling it "a delight to use."

Action is smooth and precise with the Key-8, tension and spacing are independently adjustable, speed range is five to 50 wpm, and ... well, check it out for yourself by E-mail at [n1fn@mtechnologies.com]; call (303) 752-3382; or study the images and on-line ordering options at the Web site at [http://www.mtechnologies.com].



Make 1998 a Banner Year!

Show off your club colors with a banner from Old West Graphics of Loveland, Colorado. Available in a variety of colors, banners run from two by four feet up to 20 feet long, and you can get a custom size for Field Day, your hamfest, ARES/RACES events, or any other special broadcast events. Lots of other ham-oriented goodies are to be found in their catalog, too.

Contact Old West Graphics, 490 N. St. Louis Avenue, Loveland CO 80537-5878; (800) 484-9892, ext. 8601.

We'll Be Docking in a Few Moments ...

How'd you like to be able to transform your HT into a powerful mobile or base station—instantly? Mirage docking boosters boost your RF power to mobile or base station levels, up to 50 watts; replace your HT battery; and become convenient HT holders.

The B-24-G, for two-meter FM handhelds, supplies up to 50 watts output with just .5 to 8 watts input. It has an 18 dB GaAsFET preamp with on/off switch, preamp on, on air, and transmit LEDs, for $114.95.

The BD-25 is for dual-band FM HTs. You get up to 45 watts on two meters and 35 watts on 440 MHz with only 0.5 to 8 watts input. Mirage's *FullDuplexAMP*™ lets you talk on one band and listen on the other at the same time (requires a compatible HT) for just $164.95. When you order, choose an adapter to fit your HT, $9.95 each.

For more information, call (800) 647-1800; FAX (601) 323-6551; E-mail: [mirage@mfjenterprises.com]; or check out the Web site at: [http://www.mirageamp.com].

QRP

continued from page 63

•Several short lengths of RG-58U for connecting the tuner and rig together are required. Although only one jumper is needed, it has always seemed to me that if you only bring one, that'll be the only one to fail during Field Day! A small hand-held field-strength meter is worth its weight in CW contacts as well.

•I like to take some tools with me, too. You don't need to carry the entire tool section of Sears® with you, but a few carefully selected tools will save you many a trip back home.

On my list of tools is a good digital VOM with a fresh battery. Test leads, of course, are required, and several clip leads, in good condition, are a must-have.

I also take a set of wire cutters, black electrical tape, duct tape (never leave home without it!), a small spool of solder and a butane-powered soldering iron. I usually throw in some extra PL-259 connectors and a small assortment of screwdrivers. I determine what kinds of small hand tools by the equipment I've chosen to use. Generally, I take whatever is required to get inside the rig.

If I am really out in the middle of nowhere, and a very, very long way from the nearest Radio Shack™, I take along an emergency parts kit. This kit contains a handful of 2N2222A transistors, some LM386 audio amp chips, a 2N3866 transistor or two and a 2SC1701 transistor as well. I round out the kit with a supply of .1 and .01 capacitors and some common electrolytic capacitors. Don't forget fuses! I then add some desoldering wick to the toolbox and a few feet of stranded #24 gauge wire. Sometimes having just a few basic parts can keep you up and running in case of equipment failure.

I never have been able to copy CW in my head. Instead, I have to write it down on paper as I go. I don't care to lug around scrap pads of paper. Go the local five and dime and get a "magic slate" in the toy department. These things come with a plastic pen you can write with on the top of the pad. You erase the pad by lifting the top plastic sheet. I throw away the plastic pen that comes with the magic slate and use a dead ballpoint pen instead. The magic slates are under a buck.

This is 1998; the start of the new millennium is just around the bend. All contacts during Field Day are logged into a computer. Laptops are now so inexpensive, especially those 286 clinkers, that everyone should have, or at least can borrow, one.

However, it's not my idea to carry around a desktop computer to the Field Day site to log contacts. Instead, you must have a laptop computer to get the job done. But, you don't need to use the latest and greatest laptop either. Aside from the fact that they're expensive as hell, the new ones are really power hungry. It's quite possible that the laptop computer will draw more power from a battery than the rig used to make the contacts! Bottom line: You just don't need a lot of computing horsepower to do Field Day logging.

If you can get your hands on one of the older laptops, you'll really save yourself money, and battery power. In the past, I've used a Tandy 1100FD computer. This guy has an LCD screen, DOS 3.3 installed on ROM and *no* hard drive. The processor was an 80C80 (or something close to it) and at the time the computer was new, the processor was state-of-the art. The 1100FD would run for hours on its internal six-volt battery. The lack of a hard drive is an inconvenience, but since the operating system is on ROM, there was no problem. The LCD was readable in bright sunlight, but alas, since the screen was not backlighted, it was hard to read at night. In a brief moment of weakness, I sold my 1100FD.

Check out the hamfests in your area for these computers. Also, the local computer store may be of help. Don't spend too much money on one—I'd go no more than $100 for one right now, and *that* would be pushing it.

I've seen Grid laptops with the orange gas discharge screens for $150 at hamfests. These units came with 60 meg hard drives and would operate directly from a 12-volt source. By the way, Grid laptops were used by the military.

Now, having said all of that, you need software to do the Field Day logging. And the reason why you can get by with such old computers? Old software!

There are two programs that I have used in the past for Field Day logging. They both work just great, are easy to use and will run on any computer from an 8080 to the latest super chip. Both programs are DOS based. You don't need the Windows operating system. Either one will operate and hold its data on one floppy disk, you don't need a hard drive, and thus can use the Tandy 1100FD—and best of all they're both free!

Here they are:

For text-only based Field Day logging on a computer that does not support any graphics, my choice is the program called "FieldDay" by Forrest Hudspeth WA3FAE. It's an oldie, version 1.0 copyright 1986.

If your computer can display graphics, my choice is the WR9R Field Day Logging System. This program is a fine example of the kind of programming that could be done in the days before the inflated operating systems such as Windows® came along.

Both programs generate all the necessary forms and dupe sheets. All you have to do in either one is add in the bonus points, and sign your name!

Both programs are small. The Field Day Logging System is only 60 K in size, so you can easily hold up to 17,000 contacts on a single 1.44 meg floppy disk. If you run out of space on a single floppy please contact me—I'll fly you in for our Field Day!

Okay, now that I've sold you on either or both programs, how do you get 'em? That's easy. The WR9R program is available from the CompuServe ham net. Go to the software library and search for WR9R or Field Day.

The FieldDay program by Forrest Hudspeth WA3FAE can't be found on any of the online services.

So, what's a ham to do? Well, send me a formatted 1.4 meg floppy disk, a return label and $3 for priority mail and I'll send you both programs and some sample data. My address is at the top of the column.

Now if only someone would come up with the software to use a Palm Pilot™ and store the contacts on a RAM card!

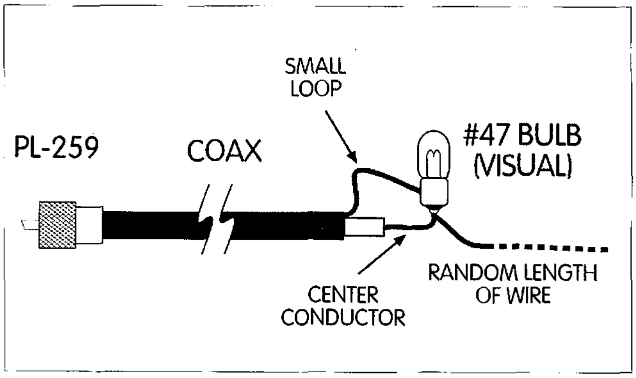


Fig. 1. WB9EAW's foolproof, "install anywhere" antenna that will get you contacts.

Some quick Ten-Tec mods for the QRP rig

These came in from Tom Kaitchuck WB9EAW. Tom's

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/
homingin/]

ARDF is off and running

International style foxhunting (also called foxtailing, radio-orienteering and ARDF) continues to make inroads in the US. As I reported last month, the American Radio Relay League (ARRL) formally recognized the increasing interest in this combination of radio direction finding (RDF) and athletics at its January meeting of the Board of Directors. In a white paper delivered at the meeting, the League's Executive Secretary Dave Sumner K1ZZ wrote: "It is difficult to predict with any degree of confidence whether ARDF will become popular in the United States, but I believe it is fair to say that for the first time, there is enough volunteer enthusiasm to give it a fair test."

ARRL's actions were welcome news to Americans and Canadians in the North American ARDF Organizing Task Force that was formed last fall. They are laying the groundwork for formal national and international competitions in this hemisphere and seeking grassroots support from hams and their clubs. That support is emerging, as my E-mail and postal mail attests.

Champions among us?

Because it is both a mental and physical challenge, ARDF appeals to both "techies" and "jocks" of all ages. It takes skill to get proper bearings, plot them, set a course and navigate through the woods. It takes physical conditioning to do it faster than your fellow competitors. Perhaps you or a fellow club member have what it takes to become an ARDF champion. Your children and grandchildren might, too. Remember, a ham license is not required to receive and track fox signals.

You don't have to be a combination of rocket scientist and marathoner to have foxtailing fun. There is a lot of trotting, walking and pausing on the course, plus a lot of head-scratching when the bearings don't appear to make sense. There is also immense satisfaction for everyone who completes the course, no matter how long it takes.

Since the first one in 1980, World ARDF Championships have normally been held in even-numbered years. In the odd-numbered years between, championships take place at the IARU Regional level. Region 1, which includes Europe, Africa and former Soviet Union states, is by far the most active. The national amateur radio societies of 29 European countries have active ARDF Coordinators. Krzysztof Slomczynski SP5HS of Poland heads the region's ARDF Working Group, the multi-nation committee that governs the sport. Region 3, encompassing the remainder of Asia and Oceania, has five countries that participate under the leadership of Chen Ping BA1HAM of China.

The odd/even sequence was broken in 1996 so that Australia could host the Region 3 championships. Region 1 championships were held in Bulgaria that year. World Championships were delayed until September 1997 at St. Englemar, Germany.

The sequence returns to normal this year with World Championships in Hungary from September 1 to 6. Hosted by the *Varosi Radioklub*, the events will be in Nyiregyhaza, 210 kilometers east of Budapest. Registration deadlines for international teams will have passed by the time you read this, but the hosts may still be able to accommodate visitors from the western hemisphere in the "friendship" category. If you are interested in traveling to the 1998 World Championships at your own expense, contact me immediately so that official inquiries can be made to the sponsoring organization. The next World Championships are tentatively planned for Australia in the month of April 2000.

There is a good chance that 1999 will be the first year in which there are IARU ARDF Championship meets in all three Regions. Croatia plans to host Region 1 radio-athletes in September, South Korea wants to host Region 3, and some industrious hams in Portland, Oregon, are working hard to earn the right to host the first Region 2 (North and South America) ARDF Championships. That event would be combined with the sixth biennial Friendship Radiosport Games (FRG), in which hams from the US, Canada, Japan and Asiatic Russia meet for friendly competitions in QSOing, CW skills, and foxtailing.

There is much to accomplish before FRG-99 can become the

***Photo A.** Carrying his control card, this runner nears the finish of an advanced orienteering course through muddy terrain, as his clothing shows. Note the "gaiters" that protect his lower legs as he crashes through the brush.*

first Region 2 ARDF Championships. Unlike the others, our region has no formal mechanisms in place to promote and govern foxhunting events. Right now there is no regionwide ARDF Working Group, no committees, and no funding. But IARU's leadership is cautiously optimistic about the prospects. Region 2 President Thomas Atkins VE3CDM writes: "We believe that 'the store is in good hands' and wish you every success in the further development of ARDF activity. I look forward to further development not only in North America, but throughout this hemisphere."

Regional ARDF Working Groups are made up of ARDF Coordinators appointed by national societies such as the ARRL and Radio Amateurs of Canada. Two Region 2 countries, the US and Canada, now have ARDF Coordinators. The subject of official support for ARDF development and events is likely to be a topic of the

---

Ten-Tec QRP rig is on 30 meters. See **Fig. 1**.

1. Homemade felt washer behind main tuning knob to steady and smooth out feel.

2. Some rigid screen or mesh between speaker and cabinet—a must to protect the speaker.

3. Tom does not say if you need a tuner with this antenna or not, but you sure *can* install it anywhere!

So, until next month, have a good time at Field Day, and send in some photos of your efforts!

IARU Region 2 Conference in Venezuela at the end of September. You can help by promoting the sport in your area, holding events, and sending your ARDF news to me so I can pass it "up the chain."

Even if it does not become a Regional IARU Championship event, FRG-99 in Oregon is sure to be a time of fun, camaraderie and international goodwill, especially for on-foot foxhunting enthusiasts. Mark next year's calendar for August 7-15 and watch for more announcements about this important event.

Rules, rules, rules

Another issue facing the ARDF Organizing Task Force is how to adapt international ARDF rules to the prevailing practices of hams in the Americas. Formal "Rules for Championships in ARDF" documents have been written and amended by the ARDF Working Groups of Regions 1 and 3. They are nearly identical, prescribing the number of foxes, power, timing and slow-CW messages. Administrative matters such as competitor categories, referees and international juries are covered in detail.

All of the above-mentioned rules are suitable for ARDF in the New World, but others are more controversial. For instance, all two-meter foxes in other IARU regions use amplitude modulation (AM) and horizontally polarized (HP) antennas. Hams here are used to frequency modulation (FM) for VHF voice transmissions. Vertical polarization (VP) is almost universal for two-meter FM in the US, to facilitate mobile operation.

ARDF fox antennas should be non-directional in azimuth, but that does not mean that they have to be vertical dipoles or whips. Omnidirectional HP antennas exist; FM broadcast stations have been using them for decades. VHF CW/SSB DX fans use turnstile or halo antennas on their mobiles to achieve HP. Similarly, Europeans and Asians have settled on turnstiles for two-meter foxes. According to Rik Strobbe ON7YD, ARDF Coordinator for Belgium, "Tests were done on terrain with many reflections, steep hills, and varying weather. Horizontal polarization proved to be the best. With HP, the attenuation in forested terrain seems to be less, which means you need less transmitter power." Some veteran foxhunters claim that multipath from trees is less of a problem with HP.

Two-meter foxhunters using yagis, quads, and phased arrays such as the HB9CV will have no trouble twisting their antenna booms to determine which polarization is being used; they can get bearings either way. But not users of time-difference-of-arrival (TDOA) sets, which are more popular in this hemisphere than elsewhere. These dual-dipole or dual-whip add-ons impose an audio tone to the fox signal. Direction is determined by the nulls of that tone. Ambiguity is eliminated by signal processing and left-right indicators. TDOA sets usually do not work well on HP signals, even if the antenna set is held horizontally. That's a strong argument for using VP foxes here, especially for events where some users will have TDOA sets.

It is not difficult to build two-meter foxes with FM transmitters, as shown in "Homing In" for March 1998. VHF-AM transmitters are more difficult to find and somewhat more complex to build from scratch. The special ARDF receiver/antenna sets favored by Europeans and Asians can usually tune in FM signals by "slope detection," at least well enough to get bearings and to determine which fox is transmitting.

On the other hand, FM receivers, including popular handie-talkies, do not properly demodulate AM signals. AM foxes sound like dead carriers to people hearing them on FM receivers. Many new ARDFers will start by using their FM handie-talkies with TDOA add-ons, or else with active attenuators (see "Homing In" for May 1998) and beams or quads. That is why the Task Force presently favors FM for two-meter foxes here in IARU Region 2.

One possible solution to the AM/FM dilemma is to use both modulation types on fox signals. ON7YD writes: "In the early years of ARDF here in Belgium, a lot of people started with FM-handies and external attenuators. Those who were really interested in ARDF soon switched to special AM ARDF receivers. At that time, we found out that the best ARDF transmissions for this population of AM and FM receivers were combinations of FM and AM. The FM discriminators in the handies still did their job well, while there was a major improvement for those with AM receivers."

"FRG-99 in Oregon is sure to be a time of fun, camaraderie and international goodwill, especially for on-foot foxhunting enthusiasts ..."

In experiments with my own FM fox boxes, I discovered that adding a small amount of AM could be easily done by modulating the LM317 IC that regulates supply voltage to the driver stages. I simply connected a 0.33 µF capacitor from the deviation potentiometer to the ADJ terminal on the LM317. Voilà! About 20% AM was now on the signal in addition to the FM.

Modulation levels of two-meter foxes should be kept low, whether AM, FM or a mixture. High levels cause unwanted receiver S-meter fluctuations and degrade the performance of TDOA add-ons. You may find that 20 to 50% AM and 3 to 4 kHz FM deviation is plenty.

In the coming months, the ARDF Task Force will wrestle with the issue of rules for Region 2. Should we break with IARU tradition to speed the development of the sport here? You can help by testing and observing in your own local hunts. Try both HP and VP. Experiment with levels and combinations of AM and FM on fox signals. Then pass along your experiences and recommendations to me.

An orienteering connection

Hams in the US have done mobile T-hunting for over 50 years, so there are plenty of veterans around to give advice and act as Elmers. But when it comes to international-style foxtailing, almost everyone in the US is a beginner. We all have a lot to learn, especially about navigating through the woods with a map and compass. But there may be some experts in your home town—orienteers—who can show you the ropes. Orienteering is a forest sport similar to foxhunting, but without RDF. Orienteers receive a marked map and must navigate to control flags with their map-and-compass skills. There is a good chance that an orienteering group is holding regular practices near you.

In my area, the Los Angeles Orienteering Club (LAOC) sponsors an event almost every month. I attended one in a 500-acre park on a cloudy Sunday (**Photo A**). Five courses had been set up ranging from 1.9 kilometers total (the "white" course) to 5.2 km (the "red" course). There was no mass start; the 60 participants were individually timed and scored. Anyone could try out the sport by paying a small fee of $5, reduced to $4 for members of LAOC.

After signing a hold-harmless release, choosing a course, picking up a map and filling out a punch card, participants

Photo B. An official at the finish line checks control cards and computes the elapsed time of each participant in this orienteering event.

logged their starting times with the official starter, copied the orienteering instructions for their chosen course onto their map, and headed out. Time limit was three hours or the scheduled end of the event, whichever came first.

Upon returning, an official checked the participants' control cards for the number of correct punches and determined their course times (**Photo B**). He tore off the stub of each control card and folded it over the appropriate string on the results trellis. This clever device (**Photo C**) makes it easy to keep track of standings continuously, without a computer. There is one string for each of the courses. Stubs are placed on the string in order of number of controls found and elapsed time. The strings can be rolled up at the end of the event and taken away for later entry into a computer or transcription into a report.

Does this give you some ideas for putting on ARDF practice sessions in your local parks? Another feature of this LAOC event was a small "String-O" course for little children, to give them an idea of the basics of orienteering. Similarly, we should put out a couple of very easy micropower transmitters on a separate frequency for demonstrating RDF equipment to newcomers before they try going out on a course by themselves.

While simple in-the-park events such as this are the most common form of orienteering, there are many interesting variations, just as there are many kinds of transmitter hunts. For example, Ski-O is just what the name implies—orienteering in snow country on skis. This sport is popular enough to have national and world championships of its own. Hams in Australia have been doing a foxhunting version of this event, called SnowDF, since 1995. They gather at Mt. Buller for a full day of skiing and trying to find two-meter fox transmitters on snowy hillsides.

Perhaps the most demanding orienteering events are called Rogaines. Named after three Australians (Rod, Gail and Neil), this sport is designed to test stamina and endurance as well as orienteering skills. Teams of at least two orienteers set out from a base camp to see how many controls they can find within a predetermined time limit, working together. Although there are short-term Rogaines of only three hours, serious Rogainers prefer events of 24 hours or more to test their night navigation skills.

A typical Rogaine course covers 75 square miles and contains several dozen controls. The route to all of them may be 40 to 70 miles total. Competitors must carry the food, water, clothing and medical supplies they need on the course, but they are permitted to return to base camp as often as they wish to munch and restock. Rogaining sites include mountains, deserts and other wilderness areas. Team members must work together, staying within voice or sight range at all times on the course.

Imagine an event like this with dozens of hidden transmitters instead of control flags! Obviously more than one frequency would be needed and many of the foxes would have to run more than a couple of watts. Now that southern California mobile T-hunters are accustomed to weekend-long hunts with up to a dozen transmitters in as many as four states, the idea of a Radio-Rogaine doesn't seem farfetched. Who will be the first to organize one?

You will find much more information on ARDF development at the "Homing In" site on the World Wide Web, including an introduction to the basics of the sport and ideas for simple inexpensive ARDF equipment. There are announcements and results of championship events, plus news of the Friendship Amateur Radio Society and the Friendship Radiosport Games. Among the 117 RDF-related Web links at the "Homing In" site are 18 links to other sites around the world devoted to radio-orienteering.

Your ARDF news and ideas are welcome. Canadian foxhunters should get to know your ARDF Coordinator Perry Creighton VE7WWP, E-mail [fars@bc.sympatico.ca]. I want to hear from readers everywhere via E-mail or postal mail to the addresses at the beginning of this column. 73

Photo C. Even with random start times, no computer is needed to figure out the winners and display the results. There is a separate string for each course with card stubs organized in order of scores.

Letters
continued from page 7

however, in reality, there are few, if any, modern two-meter receivers having a noise figure high enough to create the need for external preamplification once connected to an antenna. In a shielded system (no antenna), a 0 dB NF will create a 2 dB S+N/N improvement over the "typical" 2 dB NF receiver, certainly. Once an antenna is connected, however, this is not the case. "Atmospheric" noise (e.g., solar noise, mostly) is sufficient to override internally generated noise almost anywhere on this planet providing the receiver's NF is 2 dB or less and the antenna is normally exposed and illuminated. (In the case of unusual antenna systems, such as a very narrow beamwidth dish antenna pointed away from noise sources, this figure is reduced.) I have, indeed, used SINAD meters (owning two of them helps) to prove beyond reasonable doubt this is the case. Using "ordinary" (typical amateur) two-meter antennas, including omnidirectionals and stacked beams having >15 degree E/H beamwidth, I have never been able to achieve a SINAD improvement using my 0.5 dB NF GaAsFET preamplifier (15 dB nominal gain) ahead of my 2.0 dB NF receiver. If you have, I'd like to hear more about it!

#7—I don't think my explanation is in error. 1538 VA at 230 V is 6.687 amperes, assuming a P/F of 1.0. 1538 VA at 115 V is 13.374 amperes, assuming the same power factor. The current on the 230 V line is exactly one-half of what it would be on the 115 V line delivering equivalent AC power.

Charles Moizeau W2SH. Your December 1997 issue contains two articles, "Distributed Capacity Folded Loop" and "How to Silverplate RF Tank Circuits," both of which imply that silverplating applied to copper will improve the RF conductivity of the components receiving this treatment. In support of this opinion, each article shows a table of the relative resistivity of several metals, among them copper and silver. From the tables one might infer that because *pure* silver shows only 94% of the resistivity of *pure* copper, plating *ordinary* copper with commercially available silverplating solutions will improve the RF conductivity of the plated component by 6%.

This is quite untrue, as revealed by A.M. Fowler in an article, "Radio Frequency Performance of Electroplated Finishes," published in the May 1970 edition of *Proceedings of the Institute of Radio and Electronic Engineers, Australia*. A century ago, the smelting of copper had not reached the standards generally attained today. With a greater impurity content, it was at that time possible to improve copper's conductivity by plating it with silver. Moreover, a century ago the silverplating techniques in use achieved a coating whose properties were closer to pure silver than is the case with the plating products marketed today. Fowler maintains that the highest conductivity obtainable (in 1970) from silverplating could only reach 88% of pure silver's conductivity, and the least effective plating resulted in a conductivity of only 0.1% of pure silver!

For years, millions of dollars have been wasted, with silverplating of RF components still firmly enshrined in US military procurement specifications. However, it is false to assume that the modest conductivity advantage of laboratory grade silver over laboratory grade copper will also occur in the real world when applying the former as a plating to the latter.

Your readers would achieve better RF performance and savings in cost and effort if they avoided the silverplating exercise. Indeed, there is anecdotal evidence showing deteriorated RF performance to be the result of silverplating of copper components.

Cory Hamasaki AH6GI/4. Hi, Wayne, I saw your editorial about the IRS's Y2K problems in the February issue of *73*. I've been tracking and working on Y2K issues since 1979 and the IRS is only a tiny portion of the problem. There is a larger problem with embedded computers, banking, financial, stock exchange, insurance, manufacturing, and other non-government systems. I am a programmer with 29 years of hands-on experience on large mainframe systems and an MS in computer science. My opinion is that widespread Y2K failures are very likely, almost a certainty. I suspect that Y2K failures will cause disruptions in power, communications, transportation, the distribution of goods, etc.

I work with corporations to help them correct their software for the year 2000. Last month, a rep from a very large financial organization asked me about the possibility of using ham radio gear to communicate with their branch offices, if and when Y2K computer problems take down the telephone, cell phone, fiber optic, and Internet infrastructure. I also learned that same day that another very large financial organization has plans to stockpile diesel fuel to run their generators. Both of these organizations are household names, conservative, responsible members of the financial community but they are talking and acting like survivalist-nut cases.

I don't know that Y2K will take down the phones and power grid, that is not my area of expertise. Some experts in power distribution and computers are predicting grid failures and local outages for up to a month. This may be a good time to start amateur radio civil emergency exercises. I used to be active with the local group. We were preparing for small emergencies and did some real emergency work when the Air Florida flight hit the 14th Street bridge.

Y2K may be different. If the outages last as long as some predict, emergency generators, spare rigs, stockpiled fuel will be important. So will the ability to organize and handle large volumes of emergency traffic on a national level.

John Hicks ex-W2CIP/W3CCJ/W9GEH. After reading *NASA Mooned America* and *Moon Shot* (which was sent to me by a NASA big shot), I am persuaded that René is right. That brings up a greater question: Can one believe that an agency of our federal government could possibly be capable of such a colossal deception? My answer to that, sadly, is yes.

Sir, we genuine Americans trust every word our President, his Cabinet (including the Vice President), and our Congress tells us. We also totally trust the IRS, the FBI, BATF, DEA, NSA, CIA, DIA, and the FDA. However, for anyone interested in reading René's well-researched subversive document, it's $28 from Radio Bookshop ... Wayne.

Steve Kimber W7WEW. My wife and I can hardly wait for our *73 Amateur Radio Today* to arrive each month. We're folks who took your advice years ago and stopped smoking; we eat only good healthy foods (veggies), drink spring water, take vitamins and walk daily. We really want to thank you for your guidance and hope everyone out there will get serious about your advice and counseling.

Fat chance! Steve sent along a short non-ham article on an easy-to-make gadget which allows any fisherman to cast a minnow wa-a-ay out there. It has to do with a casting weight that drops off when the minnow gets to the bottom. Any fishermen interested can send an SASE for a copy of his clever idea ... Wayne.

QRX...

continued from page 8

Shuch. He has just returned from a two-week lecture tour of Australia and New Zealand, as part of his three-year-old effort to inform and involve radio amateurs around the world.

SETI scientists seek to determine through microwave measurements whether humankind is alone in the universe. Since Congress terminated NASA's SETI funding in 1993, The SETI League and other scientific groups have been attempting to privatize the research. Experimenters interested in participating in the search for intelligent alien life, or citizens wishing to help support it, should visit us on the Web at [http://www.setileague.org/], E-mail to [join@ setileague.org], send a FAX to (201) 641-1771, or contact The SETI League, Inc. membership hotline at (800) TAU-SETI. Be sure to provide us with a postal address to which we will mail further information. The SETI League, Inc. is a membership-supported, nonprofit [501(c)(3)], educational and scientific corporation dedicated to the electromagnetic Search for Extra-Terrestrial Intelligence.

From a press release from The SETI League, Inc.

Reach for the Sky!

Hams in Mason County, Washington, won't be encumbered by a telecommunications ordinance that would have restricted the height of ham radio towers to 70 feet and imposed other regulations. Andrew Forsberg WV7M, of Grapeview, reports that several hams in the largely rural western Washington county (population approximately 30,000) cited federal preemption over local regulation of amateur radio activities as well as the hobby's public service dimension to get the County Board of Commissioners to exclude ham radio from the new law last month.

Forsberg says that, as originally drafted, not only would tower heights have been limited to 70 feet, but building-mounted towers could not have been more than 20 feet tall. It also would have held the height of vertical antennas (called "whips" in the proposed regulations) to 15 feet. In addition, the proposed law would have required landscaping to hide a tower and lot setbacks equal to a tower's height—something often impossible on a small residential lot.

Forsberg said that, at first, the drafters of the new ordinance "seemed to be unmoved by amateur radio considerations." In addition to federal preemption, the county hams pointed out the connection between a good antenna system and ham radio's public service contributions—in an area subject to floods, earthquakes, power outages during winter storms, and even volcanic activity. Commissioners "began to soften their position," Forsberg said.

"By the time the vote was taken, the commissioners were well-informed of our position and were commending amateur radio for its outstanding contributions to the community," he added.

From the *ARRL Letter*, Vol. 17, No. 6, by way of *PARKing Ticket*, newsletter of the Piano (TX) Amateur Radio Club, March 1998.

10 Sure Ways to Destroy Your Club

1. Stay away from meetings. Show up at meetings only if you have problems or complaints.
2. Decline office or appointment to any committee. Then get angry if you are not nominated.
3. Insist on describing the club in negative terms only.
4. Never prepare an agenda, never plan the details of an event, and never coordinate with affiliates.
5. Don't do any club work if you can avoid it. Then, when the old reliables pitch in and get the job done, accuse them of being a clique.
6. If you do come to a meeting, don't speak until the meeting is finished. Then criticize and say how things should have been handled.
7. Oppose all new programs as being a waste of the membership's money.
8. When nothing new happens, complain that the officers lack imagination.
9. Read your bulletins infrequently. Then complain that you don't know what's going on.
10. Never introduce yourself to new members or visitors—make them come to you.

By John E. Matheson, *Board Briefs*. We borrowed it from December 1997's *Modulator*, newsletter of the Fort Myers (FL) ARC, Earl Spencer K4FQU, editor.

Russian Device Could Make Bombs Impotent, *Jane's Defence Weekly* Reports

Washington DC, March 19, 1998. Russian scientists have developed a compact high-current electron accelerator that could potentially stop car engines and destroy the electronics arming and firing circuits of bombs, *Jane's Defence Weekly* reports in its March 18 issue.

The device, called RADAN, is smaller than an attache case, weighs about eight kilograms, has a directional antenna and a 12-volt rechargeable battery, Dr. Ira Merritt, of the advanced technology directorate at the US Army Missile Defense and Space Technology Center, told the Congressional Joint Economic Committee recently.

Merritt said the device can stimulate the output of lasers, x-rays, wideband radio frequency and high-power microwaves. RADAN has a pulsewidth of two nanoseconds and an output pulse bandwidth from 1 MHz to 5 GHz.

JDW reports that US Army scientists have long been monitoring Russian, French and Swedish programs in this area to more fully understand the vulnerability of US battlefield electronics and computer systems to RF weapons.

"There is an increasing variety of equipment capable of generating very short RF pulses that are capable of disrupting sophisticated electronics," Merritt said.

These types of pulses, which may last a nanosecond, are not considered in many current electronics design standards and will require new forms of RF and electromagnetic interference protection.

Jane's Information Group, which publishes *Jane's Defence Weekly*, was described by the CBS program *60 Minutes* as "the closest thing there is to a commercial intelligence agency." Jane's is the leading provider of defense, aerospace, aviation, transportation, geopolitical, and police and security information to the world's militaries, governments, universities and businesses.

From a press release by Jane's Information Group.

Paraguay Orders Radio Station Off the Air

The government of Paraguay has ordered a radio station off the air for airing a phony news program that simulated a coup in progress in the country.

Radio Uno, in the capital city of Asunción, was ordered closed by the state's National Commission of Telecommunications, under a law which establishes that broadcasting must be based on the transmission of objective news from responsible sources. The program faking a coup came just two days after rumors of a real coup circulated throughout the Paraguayan capital.

From shortwave reports, via Bill Pasternak WA6ITF at *Newsline*.

The Fun Radio

continued from page 20

speaker or stereo headphones to an adequate audio level. As an option, of course, the Fun Radio could be connected to the phono input of a hi-fi audio amplifier system.

Conclusion

In years past, a longwire and ground provided the necessary signal input for the radio. With the options available today, most anything will work, but a longwire should be used for the fun of it. Also, be sure to use a good earth ground.

Build the Fun Radio and enjoy a step into the past with the fun of today. Put on the headphones—twist the regeneration and tuning dials and listen to the squeals and sounds of yesteryear!

NEVER SAY DIE

continued from page 39

anger started with portable phones, but it reached the level where the cellular companies had to funnel big bucks through their Washington lobbyists to Congress, thus forcing our legislators to put increasing pressure on the FCC which, Congress reminded them, *they* were funding. The Commissioners got the message and changed the rules accordingly.

To those who are well aware that it's money that's running our country, and that it isn't *our* money, which Congress uses with abandon, it's the millions that go into what is called (nudge-nudge) the Congressional re-election campaigns.

Britain has long had restrictions on radio listening. Indeed, they charge a tax for receivers. This is what pays for those stuffy BBC services.

Yaesu is fighting back, and though their arguments are reasonable, when big money is concerned I can't recall the last time reason prevailed. Yaesu pointed out that the modification required is not simple; that the prohibition of the public listening to the radio spectrum infringes on the First Amendment of the Constitution; that the unit in question has been authorized by the FCC for sale; that the cellular frequencies are those of the old TV channels 70-83 and that older TV sets can easily tune in on cellular calls; that cellular phones have the ability to scan and are much more easily modified for that purpose; that if phone users want privacy they should go somewhere private or use voice scrambling.

Speaking of phone privacy, many phone company employees have confided to me that the phone company has always listened in on calls as a regular practice, so that the whole idea of telephone privacy is a façade.

As I say, if reason prevails I am going to be very surprised. When reason and politics (a/k/a money) conflict, reason seems to be the loser every time.

The FCC Auction Debacle

The FCC spectrum auctions looked like a great way for Congress to get something for almost nothing. Now the Hundt balloon is bursting. Ex-FCC Chairman Hundt originated the auctions, which seemed like a wonderful idea — a way to provide Congress with more money to spend on their favorite pork projects.

In 1966 there was a bidding frenzy as start-up companies pledged $10.2 billion for channels. So far the FCC has collected less than 10% of that and there seems little prospect for the US Treasury to ever see most of it.

The auction held last April sold off spectrum at bargain basement prices. It was put on with such short notice, under pressure from Congress, that few bidders showed up. The Congressional Budget Office projected almost $3 billion in sales, but after 29 rounds (!) they raised only $13.6 million. Some bidders got spectrum licenses for as little as $1. Hundt resigned a year early "to spend more time with his family." Sure. And three other Commissioners left when their terms expired instead of staying on, which most usually do.

So far companies have bid about $23 billion for licenses, but only about half of that has been collected.

More auctions are coming, with virtually all of the spectrum except that allocated for public safety and TV subject to auction.

The FCC made it easy for the bidders, offering financing for 90% of the bid and requiring successful bidders to put down only 5% of their bid. This put the FCC into the banking business, for which it had no experience and was not at all well suited.

The FCC really should have weeded out small companies instead of courting them. Wireless communications isn't for small businesses. It requires a huge infrastructure of long-term investments and the muscle to deal with other carriers.

What does all this mean for amateur radio and our chunks of the spectrum? That would seem to depend mostly on how loud a voice we have in Washington, and that hinges on how many licensees we have, and how interested they are in what's going on. We're out there on a very weak limb.

Sorry, I'm probably boring you.

Fat

In the 1960s 17% of middle-aged Americans met the clinical definition of obesity. Today that figure is 32.2%. Worse, recent surveys show that 75% of Americans are at least 20 pounds overweight. At Dayton I see what seems to be thousands of grossly fat hams, with huge fat constipated guts hanging over their belts. The number of people with Class Three Obesity — who are too fat to fit into an airline seat — has risen 350% in the last 30 years. But it isn't just grown-ups who are fat, the percentage of preschool girls who are overweight has gone from 5.8% to over 10% in the last 20 years. And all this despite our spending $50 billion a year on diet clubs and special lo-cal and lite foods.

Despite the millions spent on special diet books, none of these diets works in the long run. None. And that goes for *The Zone*, Puhn's five-day Miracle Diet, Dr. Atkins' *New Diet Revolution*, and so on through the best-selling diet books of the last 30 years.

Okay, wise guy, if all that stuff millions of people have read and believed is baloney, then what, if anything, *does* work? You're not going to like the answer. I, personally, hate the answer. I love a slab of roast beef with lots of delicious fat. I love ice cream, the fattier the better (thanks, Häagen-Dazs — one cup of their ice cream has as much artery-clogging fat as three McDonald's Quarter Pounders™). And Lindt chocolate — yummm.

Why are babies getting fat? Surprise, it's what we're feeding 'em. The same reason you are fat and getting ever fatter. The same reason your family is fat. It's the diet you're in the habit of eating.

Fat not only significantly shortens your potential life span, it also makes what years you live more miserable. First, no one likes to look at fat people. Fat is ugly. It's a sign of a weak will. It's a clear sign that a person is self-destructive. Like smoking or drinking (including beer). Fat greatly heightens the risk of heart disease, diabetes, cancer, arthritis, gallbladder disease, gout, blindness, birth defects, and a host of aches and pains.

I got fed up (pardon) with being fat 25 years ago and went on a 1500-calorie diet for about eight months and took off 85 pounds. And, by golly, I've kept it off. But I did that by changing my diet. Today I eat mostly raw fruit and vegetables and I don't really miss ice cream or frozen yogurt. Not even fantastic Breyer's vanilla with a heaping portion of crushed pineapple on it (sob!).

Well, I understand why drug addicts have such a difficult time. Fattening food *is* addictive. If you get your kids started on it, they're going to be fat and probably unable to ever change their eating habits. I was lucky. My mother fed me real food. It wasn't until I stayed one summer with my grandparents, where my grandmother baked lots of cookies, pies and cakes, that I got fat.

How about you, can you eliminate sugar and white flour products from your diet? Can you eat mainly raw fruit and vegetables? I love 'em now.

The body you inherited was developed over millions of years to work best when it got regular exercise. Half as many Americans walk to work today as did 20 years ago. Me? I'm out there jogging a couple miles almost every day.

If you eat right and exercise, you'll lose your fat and your body will last longer and give you less pain. So forget all those magazine articles and books about diets and change your lifestyle. Sure, it takes motivation to make the change. Well, you've got that. But it also takes determination and perseverance. How are you doing in those departments? I was afraid of that. So, are you going to continue on slowly killing yourself and your family? Please advise.

Continued

Quarantined?

The announcement by Mr. Wisnosky of NASA that all plans for the exploration of space beyond near-Earth orbits had been canceled was viewed by some conspiracy theorists as proof that the extraterrestrials are calling the shots and that Earth has been "quarantined." My own conspiracy theory is that this is an admission of the inevitable — that the NASA top brass and a few other government officials know full well that man can't live for long after going through or outside of the Van Allen belt. The radiation from the Sun is just too strong for human survival without ridiculously thick shielding. Like six feet of lead.

The furor over the NASA announcement resulted in a good deal of waffling and back pedaling by NASA Chairman Dan Golden, but I doubt this is going to change NASA's long range plans.

I've enjoyed the conspiratorists on the Art Bell show who believe that our government already has well-established bases on the Moon, and perhaps even on Mars. Yawn. There's Richard Hoagland, who is convinced that there are domed glass cities on the Moon. On the back side, of course.

I've been thinking more about the Moon. Any ham who's gotten interested in meteor scatter contacts knows that there are sizable meteors hitting our atmosphere day and night. There are enough of 'em so the ionized trails they leave in the upper atmosphere are consistent enough to provide fairly dependable reflectors for communications. I recall reading that the Earth is hit by several thousands of small meteors every day, but that almost all burn up in the upper atmosphere, with only the large ones ever making it to the ground, or even to our orbiting satellites. That's an awful lot of meteors.

Well, is there any reason to believe that the Moon isn't being hit by just as many meteors per acre as Earth? And since there's no atmosphere on the Moon, these meteors would be raining down at thousands of miles an hour, peppering the Moon's surface. So how did our astronauts survive this while they were visiting the Moon?

The LEM walls were made of a thick layer of foam plastic with an inside and outside layer of 0.001 aluminum foil, so any stray meteors hitting it should have gone right through it like a bullet through toilet paper. And those space suits shouldn't have provided much more protection.

I wonder if our orbiting astronauts have been having any problems with meteors, micro or macro? Or with the tons of cometary water that scientists claim are being dumped from space on Earth every day?

Art mentioned another interesting fact. He talked with astronaut Mitchell who, when asked how it felt walking on the Moon, said that he had no recollection of it, that the whole episode had somehow blacked out for him. Well, I'd wondered why all of the Apollo astronauts have been so silent about their time on the Moon.

The high points of my life are still with me, indelibly. Like operating from Navassa (both times), from Nairobi, Kabul, Damascus, Katmandu, Kuching, Kota Kinabalu, King Hussein's palace in Jordan, the American embassy in Tehran, and working my home station from Australia on both 20m and 75m one night. Visiting the pyramids in Egypt, the junction of the Blue and White Niles at Omdurman in the Sudan, the incredible sound of Murchison Falls in Uganda, climbing the Great Wall, the terra cotta soldiers of Xian, the Taj Mahal, piloting a C5 simulator and making good landings under extreme conditions, piloting a nuclear attack submarine under the Pacific Ocean, ballooning over the South African veldt, the first time I sang solo before an audience of 5,000, working New York State from Mt. Monadnock (NH) on 10 GHz in a heavy fog — these are still as fresh in my memory as when they happened. I don't see how anyone can forget the more exciting times of their lives.

Well, it's easy to remember the details of things that have actually happened, but when one has to lie, one has to worry about getting tripped up later.

Oh yes, one more item. It seems that the space station project has also been quietly canceled. Is this part of the alien quarantine program, or a recognition that the basic purpose of the space station had to do with the cold war and thus is no longer needed by the military? I viewed it as just another government scientist welfare project.

Congressional Hocus

And pocus, too.

This fascinating tale of our Congress at work started when a pilot tried to renew his license. The FAA demanded that since he had a rural address that he provide them with a map showing the location of his home. The pilot, being a troublemaker, asked to see the law requiring a map. Well, he found, after being shunted from one department to another for several days, that they'd *had* such a rule, but it expired in 1990. They then cited Public Law 100-690. So our hero asked for a copy of that. Sorry, said the FAA, we don't have a copy.

The pilot was able, after a lot of leg work, to find a summary of the 1988 law. But the law itself, he found, was just not available. It seems that Congress printed only three copies of the law. Three, that's right. One went to the president, and left with him when he checked out. No one knows where to find that copy. It's somewhere in a warehouse. The second copy went to the Senate. Nobody could find it. The third went to the House, which sent it to the Library of Congress. It's there, but they don't loan it out. No, there is no microfilm copy either.

The summary was interesting. The law authorizes the assignment of HHS personnel to work within organizations and the use of traditional native Hawaiian healers as well as Western-trained medical personnel. It establishes the declared policy of the US Government to create a drug-free America by 1995. It includes provisions to restrict the sale or issuance of bank checks, cashier's checks, traveler's checks or money orders for cash in transactions involving more than $3,000. It prohibits the distribution of obscene matter by cable or subscription television. It requires an OJJDP study of illegal parental abduction of children. It requires DOT rulemaking regarding the trucking industry use of emergency flares and maintenance and inspection of brake systems.

Well, it goes on like that for God knows how many pages.

There was something about the FAA giving special attention to pilots using mail drops or a post office box, but nothing about rural box holders. Our pilot checked Miami pilots' addresses and found 74 pilots all with the same suite number (mail drop). So much for the FAA's following their own rules.

I thought you might be interested in this tiny tip of the federal iceberg. Yes, when our pilot hero forced the FAA to go to court their lawyers listened to a few of the things he'd found and quietly gave him his license to shut him up.

Hug Me

Can I get you to stop poisoning yourself with sugar, coffee, alcohol, nicotine, and dental mercury? Can I get you to exercise every day, reduce your stress, and drink large quantities of distilled water? The results are worth it and you'll be in line to hug me at Peoria in September. You *are* going to come and see me at Peoria, aren't you? The hamfest is September 19–20th and I expect you to make a major effort to be there, armed with questions.

Yes, I'll be playing the same health-wealth tune I lay on you every month. Hello, is anybody home?

Titanic Goof

Yep, I enjoyed the movie. The computer-generated graphics were amazing! But one of the key elements in the disaster which the movie forgot to mention was discussed by Titanic expert Jim Clarey on the Art Bell show. It seems that after the collision with the iceberg, which ripped a hole in the forward part of the hull, the captain put the engines on half power and steamed ahead at 12.5 knots for over 20 minutes. This had the effect of jamming lots more water into the hole, which caused the ship to sink much faster that it might have otherwise. If he hadn't done that many more lives could have been saved. It also made it impossible to launch the lifeboats. What was he thinking? He apparently still believed the ship was unsinkable and was still hoping to set a record time for the crossing.

Prisoners

We're all prisoners — and we don't even know it. We're so used to the prison walls that they look normal to us.

What do I mean by this? Most of us are prisoners of the food eating habits that our folks taught us. We are prisoners of the religion they taught us to believe. We are prisoners of many things that we were taught to believe when we were young and which, by now, are solid mental prison walls.

I wrote a piece some time back pointing out that if you believed in doctors you were a sucker. That if you believe in the value of college you are a sucker. These are beliefs that we are all taught when we are children and which are reinforced by our media, in articles and news reports written by other people who have been similarly inculcated (brainwashed).

What I haven't discussed is the power of these beliefs. If we believe something then it is going to be true for us. If a doctor, a person in whom you believe, tells you that you have an incurable illness, then I guarantee that you really *do* have an incurable illness and that "it" is going to kill you. Well, being more honest about it, you are going to kill yourself using this illness.

I started to get an idea of the power of the mind when I read what was possible under hypnosis. Like phenomenal feats of strength. Like eidetic recall of events. Then, as I became accomplished in the use of hypnosis I understood even better the incredible power of the mind, once it is disconnected (unlocked) from the beliefs of the conscious mind.

Imagine a person whose memory, strength, and senses are not being hobbled by their conscious mind and the beliefs controlling (imprisoning) it. Yogis are able to control their body temperature, their heart rate — even to stop their hearts — and almost every other autonomic function of the body. They can anesthetize any part of their body. These things show us the abilities of unlocked minds.

Then take people with multiple personalities. The more you read about them, the more you can appreciate the degree to which the mind is controlling us. Multiple personalities can have different eye colors, different allergies, different illnesses. Even serious illnesses.

There is abundant evidence that most, if not all, of our physical illnesses are triggered by our minds. Yes, nutrition, dehydration, and putting poisons into the body can wreck your immune system, but without the mind triggering an illness, it'll take a lot longer to kill you.

One of the main things I did to help people under hypnosis was to find the times in their past when the destructive beliefs were programmed into their subconscious minds, and then I erased the power of that programming.

I once wrote about Dwight Bulkley's research, where he discovered that virtually every accident people have can be traced back to a traumatic event about 33 hours earlier. Even accidents which seem completely out of the blue.

And that brings up the weird coincidences which we label as synchronicity. Somehow the power of our minds can make things happen. I've recently referred to three books which explain how you can harness this power and use it for your benefit. One is Scott Adams' *The Dilbert Future*, which is a fantastically funny book — except for the last chapter, which explains how you can use this power of your mind. Bevy Jaegers has a book on the subject, as does Eugene Maurey. See my *Guide*.

How can plants know what we are thinking? How can they identify any one person from a group? How can a dowser locate water or oil, or even a missing person by dowsing a map? How can our cells stay in instant communication with us (and each other), even when separated by thousands of miles?

It would be interesting to research what happens to a blood donor when the donated blood is put into a sick person. Can that sickness be communicated back to the donor in some way via the donor's blood cells mixing with the sick person's blood? Ditto organ transplants.

Changing our diet from what we were brought up to eat is extremely difficult. Getting over the thoroughly inculcated belief that we must go out and get a job instead of starting our own business when we grow up is almost insurmountable. Overcoming childhood beliefs in inferiority is a bitch. If we find that being sick is the solution to our childhood problems we're going to use that response later on.

Even something like a cold or the flu just isn't going to happen to you unless there is some stress that triggers it.

Our medical industry is totally under the control of our pharmaceutical giants, so you know there aren't going to be any research projects funded to find out how to avoid being sick. Unless you get sick, the drug companies, doctors, hospitals, insurance companies, and so on won't make any money. They all have a powerful interest in keeping as many people sick as they can. And money doesn't just talk, it plays the tune we all are dancing to.

How sick are we making ourselves? There is abundant evidence that our cells are designed to operate for about 150 years, so we're living only half our possible lives, on the average.

If you can convince yourself that you are very healthy and are going to stay that way, that's the way you'll be. Oh, you do have to give your body a break by supplying it with the food, water, sun and exercise it was designed to use, and to stop poisoning it.

Yes, we are our own worst enemies. The so-called placebo effect can cure us — or kill us.

We complain about the rat race, yet it is our lack of initiative which imprisons us. Like sheep.

A hundred and fifty years of our public school system has trapped us, our parents, and their parents before them. The school system was originally chosen by church leaders of the day because it had been so successful in producing unquestioning soldiers for the Prussian military, a group that made possible the might of Germany.

This was exactly what the industrial revolution needed to produce an endless supply of production workers who would do what they were told without asking questions.

So here we are, the products of 150 years of mind control. And we help by passing along the system to our children from their earliest days as basic programming, when their minds are being formed. It's like Microsoft's operating system, only *our* windows have been opaqued so we can't see through them to see what the world is really like.

So we believe in working for others for a living. We believe in our political system which intrudes into our lives with laws and government bureaus which are doing things "in our best interest." Sure. We believe in our religions, in our

doctors and hospitals, and never mind the facts. We believe in ball games, TV advertising, and the promises of our food conglomerates.

How can you free yourself of several lifetimes of mind control? How can you free yourself of the tyranny of the rat race? When you have your own company you can't be fired, downsized, made redundant, or laid off. If you know what you're doing you'll have plenty of money to do the things you want — to travel anywhere — and even live where you want — if you plan it right.

I started *73* from a tiny office over a grocery store in Brooklyn, New York City. A little over a year later I rented a U-Haul truck and moved to the mountains of New Hampshire, where I now live on a 200-acre farm on a hill overlooking the beautiful Contoocook River valley. We've got deer, wild turkeys, pheasants, coyotes, wolves, foxes, bears, beavers and moose for neighbors. Wild flowers are everywhere, wild raspberries, blackberries, blueberries, and strawberries too.

Oh, I was trapped in the city for 30 years. Fighting rude, angry people, car exhausts, filthy air, jammed subways, ever fearful of being robbed or conned. I feel so sorry for the millions of people who are trapped in our cities — trapped and being brainwashed into accepting the system. Driving in long, slow lines to and from work every day, or packed solid in subway trains. Working at jobs with little future.

Oh, I'm a sucker too. I can't help myself. I tend to believe in people and trust them. Over the years I've brought many people to my area to work for me, often helping them buy homes. I remember the first chap I did this for. That was Jim Fiske W1DTY, whom I brought in from California. I paid the way for him and his family. I gave him the money for the down payment on a beautiful home on a nearby lake. I got my reward when he left to start a competing ham radio magazine in a nearby town. But before leaving he did his best to get rid of as many of my subscribers as he could by dumping all our computer records, and stopping the sending of renewal notices for almost a year.

Yes, I kinda let all this happen by being distracted with the pain and distress of my first divorce. That really knocked me out for a couple of years, complete with chronic fatigue syndrome, which left me unable to work for more than a few minutes a day.

Almost losing *73 Magazine* helped snap me out of my funk. I had to work 18-hour days for a couple of years to salvage it, but soon it was bigger and better than ever and *Ham Radio* blew away.

Did this stop me from bringing people to New Hampshire to work for me and buying them houses? Of course not. And every one of them screwed me in return. Several royally. I just shrug it off with a "big deal." I'm not going to waste my time fretting about stuff like that. Well, yeah, I do grumble.

Say, is there any chance that you can start thinking for yourself?

One more thing — if *any* of the prophets are right about the future you people living in cities are going to be wiped out. And some of these prophets have some amazing records for being right.

Music Lessons

Did you see the report in the papers showing that toddlers who take music lessons develop higher IQs? Yep, the study showed that youngsters who'd had eight months of music lessons, classical or jazz, excelled at intelligence tests involving higher brain functions, doing significantly better than similar children who were not given lessons.

The music apparently stimulates the same brain areas used to form mental images of objects and understand changes in their positions. Well, we know that the more we can get children to use their brains, the more neuron connections are made in them and the higher their IQs. As I recall, if you pass this critical time by without providing the stimulation for neuron growth, then the opportunity is missed. It's like learning languages. Kids of two and three can learn almost any number of languages and learn to speak them without an accent. When you wait until a few years later it's much, much more difficult to learn a new language. If you had to learn a language in high school you know what I'm talking about.

My thanks to N1GLW for the newspaper clipping on this one. The report comes as no surprise to me.

Wellness

By luck, or perhaps perseverance, I've managed to find a book that's a gem. It's only $6 and is worth a hundred times that to you. It's *Wellness: Just a State of Mind*, by Eldon Taylor. This 107-page book really does explain the connection between wellness and your attitude. It explains how and why when you expect the worst, that's what you get. And conversely, when you expect the best, you get that. Your sickness, bad luck, and so on are all your own doing.

I've always expected good luck, and I've usually had it. All of my really big disasters have come from my trusting people.

"Purely practical logic teaches us that becoming angry or stressful does not produce happiness or joy. As a matter of fact, anger or stress produces only more anger or stress — to say nothing of the toxins such negatives generate in our bodies and slowly poison us." Confirming that we're our own worst enemies. Or, our own best friends. I think you'll really enjoy the book and it may even help you have a healthier, happier life. Or would you rather keep being angry and stressed, get sick and die. Your choice. R.K. Book, 816 W. Big Bear Blvd., Big Bear City CA 92314. ISBN 1-55978-034-7.

Your mind can not only make you sick or well, it can even change your physical characteristics — like blood sugar or even eye color, and at a snap of the fingers. Some multiple personality people have diabetes in one personality and none in another. Maybe it's time you learned more about your mind and what it can do for or against you.

Magnets

Stas Yascolt N8GRX of Pinconning, Michigan, was kind enough to send me a *New York Times* clipping about a new study showing that magnets are being used successfully to alleviate pain. The rest of you who read the item didn't bother to send me a copy. Tsk.

My life is complicated enough with reading books and magazines, so I've avoided reading newspapers for years. Thus, when you see something I ought to know about in a newspaper, I hope you'll send me a copy. Jeeze, is that too much to ask?

The main problem with using magnets to get rid of pain is that there is no way for the pharmaceutical companies which are running the medical industry, the FDA, NIH, WHO, and so on, to patent magnets and sell them at a high price, the way they can their drugs.

Not that I'm a big fan of pain reduction. The body uses pain as a warning that we're doing something wrong. So we take an aspirin to get rid of the pain instead of stopping whatever is causing the trouble. And that makes for even more trouble later.

Arthritis sufferers are plagued with pain, so they naturally wolf down pain pills instead of changing the diet that's giving them arthritis, which is 100% the result of doing their body years of damage ... mostly with sugar.

But magnets can help get rid of pain, though no one knows how they work. They also can greatly speed the healing of wounds, even on animals. I suspect it has to do

with the magnet increasing the blood flow to the painful area.

Before the recent study showing the success of magnets was released they were considered quackery. Indeed, Professor William Jarvis, a professor of public health and preventive medicine at Loma Linda University and the president of the National Council Against Health Fraud recently published a paper calling magnet therapy quackery.

Doing Your Homework

Do you have a strong opinion on global warming? Would you be willing to spend $15 to get the facts? Here we are, with Congress getting ready to slap a carbon tax on fossil fuels to help "save the planet" from the greenhouse effect, caused by mankind's careless burning of gas, oil, coal, and forests. Even if your congressman hasn't the time to find out the truth, maybe you can educate yourself about this and make yourself unpopular with ecology fanatics.

Arthur C. Clarke says that *Hot Talk, Cold Science* by Fred Singer shows that the evidence that mankind has influenced the global climate is, at best, sketchy and incomplete. The book is published by The Independent Institute, 100 Swan Way, Oakland CA 94621. Send for their catalog.

Also, if you believe that raising the minimum wage is going to benefit any workers, it's time to do a little more reading. In *Out of Work* you'll find out what damage the minimum wage has done so far, as well as the harm done by welfare, unemployment compensation, and labor controls. For an employer it's one hell of a mess. For the worker, it's worse in the long run. Same publisher, $19.

Doomsday?

Yep, still another doomsday scenario! It seems as if we're going to be in deep trouble yet another way. It wasn't bad enough with the runaway greenhouse effect going to parboil us, or the coming ice age going to freeze our galuccis, or the poles going to shift to what is now the equator. No, this one is even worse!

By the way, I got an excited call from René the other day. He'd finally been able to confirm through astronomical sightings that our beloved Earth does *not* have a bulge at the equator. This helps confirm the theory that the past ice ages were the result of the Earth's axis shifting, rather than the whole world getting colder.

This is not inconsistent with Noone's theories in his book, *5/5/2000*. It also ties in with the Mayan calendar prophecies.

Anyway, I've read a new book. It's a scary one, too. This is by Dr. David Jacobs of Temple University in Philadelphia: *The Threat*. The subtitle is "The secret agenda: What the aliens really want ... and how they plan to get it." Unfortunately, Jacobs makes a good case. If you're interested in preserving your semi peace of mind, for heaven's sake don't read this book. It's a 287-page Simon & Schuster 1998 hardcover book.

Jacobs has interviewed hundreds of abductees under deep hypnosis, trying to find out what the aliens are really up to. Yes, I know about false memories and all that. I've had a good deal of experience in using hypnosis, so I know how to avoid coloring the memories of a person under hypnosis. So does Jacobs.

What he found was that most abductees were started when they were youngsters, with frequent abductions, all wiped clean from their memories. Later abductions involved collecting sperm and eggs for hybrid breeding purposes. Then fetuses are implanted in the female abductees and allowed to grow for several months before being removed and grown until birth in incubators. The results are hybrids that look like us, but have very docile personalities. No one has a clue as to how many thousands or even hundreds of thousands of these hybrids have been grown.

What Jacobs did find out, through hints from many abductees, was that some sort of major world catastrophe is due, perhaps next year, at which time the ETs will replace us with these hybrids.

How come hybrids? Well, it seems that the aliens (the grays) are not well adapted to our atmosphere, so they needed to create (engineer) a hybrid race that was adapted to our world.

With their technology being thousands of years ahead of us, and with their ability to read and control our minds, the takeover and wiping-out of most of what's left of the human race after the catastrophe shouldn't be difficult.

But doesn't our government know about this? Some parts of it do, but they've been busy shielding us from what's been going on.

If Jacobs' scenario is right, it's already too late for us to get busy and do the research on ESP, telepathy, and so on that it would take for us to develop our minds so they could deal successfully with the aliens' ability in mind control.

You have the choice of doing some research for yourself on this or shrugging your shoulders and mumbling about Wayne Green being crazy. Before you turn away, thinking maybe I'm naïve, do me the favor of checking the data out for yourself.

The other millennial-doom-and-gloom scenarios hold out the hope that some of us will survive, and that come the catastrophe, amateur radio communications could be a major factor in pulling things back together. Dr. Jacobs is silent on what we might be able to do about this, even if everyone could be warned.

Those Darned ETs

After hearing Jim Marrs on the Art Bell talk show I quickly got his book, *The Alien Agenda* (Harper-Collins, ISBN 0-06-018642-9, 434 pages, 1997, $24). Jim has done a massive amount of research into the ET-UFO situation. If you are naïve enough to buy the Air Force's debunking of UFOs then you may not want to upset your view of the world with facts. Well, most people seem to prefer *Geraldo* to PBS.

As you read the history of what's been going on you'll understand better why the government has gone to so much trouble to cover up the situation. Yes, there *are* UFOs, and ETs, and they've been around for a long, long time. There are, actually, quite a few different ETs from many solar systems and even galaxies, all keeping track of us.

Jim covers the crop circles, animal mutilations, interviews with abductees, the results of remote viewing, etc., putting things into perspective and speculating on the ETs' goals. I've written about the crop circles a few times. Are you aware that the real ones, and that's almost all of them, can't be duplicated by any known technology that we have? Ditto the cattle mutilations.

How much do you know about remote viewing? Do you know that our military used it to locate Russian submarines and that it is a very reliable system?

I recommend the book.

Kids 'n' Computers

How come computer hackers are mostly teens? How come software companies are out there robbing high schools, paying some 17-year-old kids $50,000 a year for working three days a week? The Department of Labor reports that 22,000 teens, from 16-19, worked in the computer data processing industry last year. That's more than four times the number three years earlier. What's going on here?

The key, I suspect, is the amount of time and interest teens can devote to computers, not some inherent genius. It takes time, patience, motivation, and an inquisitive mind to deal with computers. Teens who are not wrapped up with cruising, watching ball games, or TV have the time it takes to get good at

programming. Once they're in college, the work load doesn't allow as much time for building computer skills. And then, when they're working and have families, their spare time is so restricted compared to high school students' that they'll never catch up.

This also explains why so many of these computerized teens are nerds. The more gregarious kids are busy dating, cruising in cars, and standing around corners endlessly talking about nothing. Heck, it was the same two generations ago with teenage hams. Nerds, for the most part. If they'd had computers when I was a teen I'd have been right there in the middle of them, hacking away.

Luckily, in a way, I've never grown up, so when the first microcomputer kit was announced I had to be one of the first to get one. That was the Altair 8800, back in 1975. There was no software for it then. Not even a keyboard, so I got a South West Tech Products keyboard and used that. When Bill Gates turned up at MITS a few months later with his cobbled-together version of Basic for the 8800 I got an early cassette copy. It was a bear to use. I often had to load it several times before it would run, and then there wasn't a lot to do with it.

But I was so busy with *73 Magazine* that I didn't have time to get nearly as involved as I would liked to have. I saw the potential for this new technology so I got busy starting *Byte* magazine, which left little time for me to become a software expert. It took an enormous amount of my work to launch the new magazine, even though I had the help of the *73* staff with the production phase.

Any adult who has the time and interest can get very good at computer hacking. And, considering the money out there for someone with computer smarts, maybe it's worth the time. Of course, as one gets older, one tends not to be as creative in one's problem solving, which explains why virtually all major new technological developments have been pioneered by youngsters. On the other hand, our public schools are doing more and more to discourage creativity and motivation, perhaps giving old-timers an edge.

In the ham field NBFM, slow scan, sideband, repeaters and so on were all developed by youngsters. Since, for the last 35 years, we've been discouraging youngsters from entering the hobby we've had almost no important new modes of communications develop. From 1946 (right after World War II) until 1963 80% of all new hams were teens, with 50% being either 14 or 15 years old — the same age group that is now doing so well with computers. That was the golden age of hams, developing and pioneering new communications modes.

The jobs are out there. Gobs of well-paying jobs, if you can hack it.

Cacophony

With pirate microstations popping up all around the country there is a move afoot for the FCC to legalize one-watt stations for use on one FM and one AM channel, with antennas no more than 50 feet above the ground. If this goes through you might be able to generate quite a business in putting together the Ramsey FM transmitter kits for the electronically impaired. My adventures with the Bioelectrifier have convinced me that the average American hasn't a clue as to how to connect two batteries together in series, and is afraid to even learn.

One could, I expect, build quite a business making microstation transmitters and operating consoles.

The idea is attractive. Many teens would like an opportunity to have their own broadcast station where they could play the music they like (ugh!!!) and make endless uninformed social commentary. With a hundred thousand or so stations, all on one channel, the results should be less than fascinating and make our repeater wars of the '60s pale by comparison. That was before I knocked heads together and repeater channels were standardized.

I'll be surprised if this one doesn't go through.

No Problem?

You probably haven't been paying as much attention to the Asian stock market meltdown as you have ball scores or Clinton's sex problems, but this could have a longer lasting impact on your life. And mine.

Is "meltdown" an exaggeration? The Japanese market dropped 25% last year, Singapore ditto, Hong Kong 27%, the Philippines 55%, South Korea 59%, Indonesia 60%, Malaysia 68% and Thailand 75%.

So what? Tough on them, right? Alas, though countries are splitting apart politically, world commerce and finance have been growing into a tightly interconnected web. The world's money goes where the interest rates are highest and money is most secure. Sinking currencies and markets are quickly abandoned, spiraling economies downward. This is what has been pushing the dollar upward against the other currencies.

This, in turn, will force businesses in Asia to cut their prices to the bone to try and export their way out of their misery. That will put our American competitors at a severe disadvantage, while at the same time pricing American exports out of foreign markets.

Foreign investment in China dropped by 40% last year, so even Communist China is not immune to the problem. Worse, the Asian markets were buoyed up mainly by over-valued real estate loans by their banks. We saw the results of that just a few years ago when a recession hit New Hampshire very hard. Housing values quickly plummeted, forcing thousands of home owners to abandon their homes when the values of their homes dropped way below their mortgages. The banks then auctioned off the homes for anything they could get and we saw most of the New Hampshire banks disappear, washed away in the flood of loans turned bad.

You surely remember the hundreds of billions of dollars the government had to shell out to cover the savings and loan debacle. In Asia the governments aren't going to protect bank depositors.

This is not a good time for American businesses to expect to expand their foreign markets. This is when they should be producing products aimed at American customers.

Epilogue

Now for the commercial. Naturally, I want to you buy my booklets. The most important one is my $5 review of books you ought to be reading (order B). Next is the $10 story of the Bioelectrifier, complete with a reprint of the Miller article on how to build one. This may help with emergency repairs to your body that your bad habits have brought about (order A). Then there's *Making Money*, which for a lousy $5 explains how you can make all the money you want, with or without any diplomas (order M). I've reprinted my 1998 Jan-Apr editorials in one 92-page book for you for $5 (order J). And my 1997 editorials run 240 pages for $15 (order O). There's 45 of my older ham-oriented editorials, which are great grist for ham newsletter editors $5 (order P). There are two reprints of 50 earlier non-ham-oriented editorials, *Grist I* and *Grist II*; these are $5 each and both run 60 pages (order F & G). How can you live happily without getting my exciting World War II adventures in a top-scoring submarine? $5, 60 pages (order S). The travel diaries of my visit to the hams and scuba diving of a bunch of Caribbean islands, 84 pages, $5 (order U), and my travel diaries of Sherry's and my visit to Rus-

Continued on page 87

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU/7
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

As the calendar indicates, about half of the days this month show Good or Good-to-Fair propagation (G, G-F/F-G) on the HF bands. The remaining days will probably provide only Poor (P), or Poor-to-Fair (P-F/F-P) conditions. Summer months seldom provide good DX, and *now* because we are in the *low* solar flux portion of new sunspot cycle 23, DXers face plenty of operating challenges to snag rare DX. In spite of this rather gloomy outlook, the days between the 15th and 22nd, and again on the 28th and 29th, appear to represent your best opportunities for DX contacts. Remember, however, that propagation forecasts are only educated guesses, and the most successful DXers are always alert for sudden and unexpected opportunities.

10–12 meters

You may expect occasional short-skip openings from about 500 to 1500 miles. There may be rare openings to greater distances, but not regularly.

15–17 meters

You can expect some reasonable short-skip propagation out to 1500 miles or so, and occasionally greater distances, particularly transequatorial DX skip—with sometimes surprising signal strengths.

20–30 meters

As almost always, 20 meters will be your best DX band for both daytime and evening periods. 20 will stay open until well after dark, and 30 really begins to shine in the late evening hours. Peak conditions exist shortly after sunrise at our location, and again in the late afternoon. Midday conditions are not likely to be good due to excessive ionization and absorption. Short skip will be excellent out to about 2500 miles on both bands on the best days.

40–80 meters

Forty will be excellent after dark unless the noise levels from thunderstorm activity are excessive. These will be "all-night" bands, with 40 slightly better than 30, except for noise. Daytime short skip will average 1000 miles or more and nighttime short skip will average 1500 miles or more—usually more.

80–160 meters

These two bands are not known for summertime DX because of high noise (QRN) levels. However, on quiet evenings you may find superb DX across the Atlantic on 80 meters for US and European hams. 160 is always a summertime problem, but those of you with Beverage antennas for receiving and vertical antennas for transmitting will do better than average.

Gray-line DX

Always be aware that a half hour before and after local sunset often provides some really fine DX along the paths of darkness on all bands. *Use it* to your advantage. W1XU/7.

Note about chart: The indicated band is only a guide. Always check the next higher or lower band. Where 10 meters is shown, listen on 12; where 15 meters is indicated, listen on 12 and 17; and so forth.

June 1998

SUN	MON	TUE	WED	THU	FRI	SAT
	1 F-P	2 P	3 P	4 P	5 P-F	6 F-P
7 P	8 P-F	9 F	10 F	11 F	12 F-P	13 P
14 P-F	15 F-G	16 G-F	17 F	18 F	19 F	20 F-G
21 G	22 G-F	23 F	24 F-P	25 P	26 P-F	27 F
28 F-G	29 G	30 G				

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
EASTERN UNITED STATES TO:												
ALASKA							20	20				
ARGENTINA								15	15	15	15	15
AUSTRALIA						40	20	20			15	15
CANAL ZONE	20	40	40	40	40		20	15	15	15	15	20
ENGLAND	40	40	40				20	20	20	20		
HAWAII		20			40	40	20	20				15
INDIA							20	20				
JAPAN							20	20				
MEXICO		40	40	40	40		20	15	15	15	15	
PHILIPPINES							20	20				
PUERTO RICO		40	40	40			20	15	15	15	15	
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA									15	15	15	
WEST COAST			80	80	40	40	40	20	20	20		
CENTRAL UNITED STATES TO:												
ALASKA	20	20						15				
ARGENTINA										15	15	15
AUSTRALIA	15	20				40	20	20				15
CANAL ZONE	20	20	40	40	40	40			15	15	15	20
ENGLAND		40	40					20	20	20	20	
HAWAII	15	20	20	20	40	40	40					15
INDIA								20	20			
JAPAN								20	20			
MEXICO	20	20	40	40	40	40			15	15	15	20
PHILIPPINES								20	20			
PUERTO RICO	20	20	40	40	40	40			15	15	15	20
RUSSIA (C.I.S.)								20	20			
SOUTH AFRICA										15	15	20
WESTERN UNITED STATES TO:												
ALASKA	20	20	20		40	40	40	40				15
ARGENTINA	15	20		40	40	40					15	15
AUSTRALIA		15	20	20			40	40				
CANAL ZONE			20	20	20	20	20	20				15
ENGLAND									20	20		
HAWAII	15	20	20	40	40	40	40					15
INDIA		20	20									
JAPAN	20	20	20			40	40	40			20	20
MEXICO			20	20	20	20	20					15
PHILIPPINES	15						40		20			
PUERTO RICO			20	20	20	20	20	20				15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA										15	15	
EAST COAST		80	80	40	40	40	40	20	20	20		

NEVER SAY DIE

continued from page 86

sia and many other great places, 72 pages, $5 (order T). There's a $3 s/h charge for any total order. MC or Visa are okay. Order from Wayne Green, 70 Hancock Road, Peterborough NH 03458. Yes, of course I'll send you a catalog of my other stuff.

Including Ham Radio Fun!

73 Amateur Radio Today

JULY 1998
ISSUE #454
USA $3.95
CANADA $4.95

International Edition

Darko Rusman T95A

Build a CW ID

80m RASER Beam

Timeout Battery Saver

Build an RF Ammeter

Vintage Ham Gear Prices

Review:
Pasokon's SSTV System

0 74851 08725 1 07

THE TEAM

El Supremo & Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
J. Clayton Burnett
Priscilla Gauvin
Joyce Sawtelle

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Jack Heller KB7NO
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister W5ACM
Dave Miller NZ9E
Joe Moell KØOV
Steve Nowak KE8YN/5
Carole Perry WB2MGP

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

JULY 1998
ISSUE #454

73® Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

FEATURES

REVIEW

DEPARTMENTS

HAM RADIO FUN SECTION

On the cover: Darko Rusman T95A lives and works in Bosnia, 14th rarest DX country in the world. He is a radio operator working with the United Nations High Commission for Refugees in Tuzla, and one of Bosnia's most active hams. On good weekends he works as many as 500 stations around the world, concentrating on the United States. Photo submitted by Jeffrey L. Baker T98WKU & WK3U.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107.

The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Rx Laughter

Laughing is good for you, so stay the heck away from 14.313. Laughing helps block pain, relaxes your muscles, fights infection, and reduces emotional stress. Certainly, by now, you must have read or heard about Norman Cousins' laughing his way out of ankylosing spondylitis, a debilitating arthritis-like illness.

This Rx came to mind when I was reading the cover features about the *South Park* TV series on the Comedy Central channel in both *Newsweek* and *Time*. And in *TV Guide* too. Most of the episodes break me up, but the Christmas one about Mr. Hanky had me laughing until I was gasping for breath. They keep repeating the older episodes, so keep your VCR handy and save 'em all for when you need a pick-me-up.

If you've heard me being interviewed on the Art Bell (W6OBB) radio talk show or attended any of my talks at hamfests you know I love to laugh. I don't take very many things seriously. Heck, if I did I'd have been dead a long time ago.

So I buy the *Dilbert* books and get big loud laughs as I read 'em, over and over. And I get some great laughs from *The Simpsons* and *Roseanne* reruns.

Say, if you know of any books or other stuff that might get me laughing, drop me a note. If you're too cheap to spend the 32¢, then send it via [design73@aol.com]. I read my snail stuff every day and my E-mail once a week (or so).

In my *Guide to Books* I list several books that always make me laugh. Have you ever read any of H. Allen Smith's books? Or the old Alexander Botts stories by Upson? Then there's Thurber, Benchley, and Potter. Don't forget O'Rourke!

Staples vs. Paper Clips

Staple users tend to be uptight and impatient. Bam, and they're done with it. Paper clip users understand that nothing is permanent, so they like to make it easy to change things. I've noticed that paper clip people tend to be more creative, open to new ideas and developments, while the staplers tend to be firmly stuck in their ingrained working, living, and thinking habit patterns. Worse, many staplers tend to be seriously disorganized, so I suspect that staples give them a false sense of organization. Let me know if you see any correlation between staple users and people who are self-abusers — like smokers, coffee drinkers, or alcoholics.

I don't have a stapler anywhere near my working areas, but I do keep a staple-puller at hand when I'm opening the mail so I can deal with the seldom-worth-reading stuff from staplers.

Energy Sources

To get an idea of what the cold fusion crowd (can such a small group be called a crowd?) is up against, consider the size of the industries that could be decimated by this new technology. Now, if you were an executive drawing down six or seven figures in one of the companies presently supplying energy, what would be your reaction to a new energy source which threatened to supply energy at one-tenth of the cost of *your* product?

Today 40% of our energy comes from oil, 25% from natural gas, 23% from coal, and 12% from hydro, wind, solar, and nuclear. These giants aren't going to be blown away without a fight. A very big fight.

Right now their influence can be felt with the disinformation campaign to discredit cold fusion: the Department of Energy's head calling cold fusion a hoax, and the Patent Office refusing even to consider any cold fusion patent applications.

Alas, there's nothing new about this situation. Every new technology has faced similar battles.

You've probably read about the court-martial of Billy Mitchell, who claimed that airplanes could sink a battleship. By a coincidence, my father was there at Langley Field at the time as a pilot, working with and a good friend of Mitchell. I was there, too, but I was a little too young to remember the celebrated case. I do remember my dad taking me up in their Martin bombers. Heck, he first took me up when I was two months old, so I've been flying since 1922.

Ooops, I'm off on a tangent. Golly, that's never happened before!

The biggest use for oil (1998 figures) is for personal vehicles (34%), then for trucking (20%), industrial fuel (8.3%), air transport (7.6%), heat and power (7.3%), water transport (2.7%), and other misc. (8%). Thus the biggest change is going to come about when cold fusion generators are adapted to vehicles, thus eliminating half the need for oil, refineries, tankers, and corner gas stations. Gee, we'll sure miss all those gas stations that uglify our towns, right?

It seems downright greedy and shortsighted to me to totally use up the whole world's supply of fossil fuels before we make a serious effort to develop alternatives — particularly much less expensive alternatives. There seems to be this mindset that we are the only generation of people on the Earth that's important — let our grandchildren take care of themselves, as long as we have jobs and make money today.

There's nothing new about this. We've forced extinction on many species in the past and we're doing well toward extincting most of the African wildlife. England at one time teemed with elephants, tigers, hippos, and dense forests. So did the rest of Europe.

Thus we can expect self-interest in the energy companies to do its best to stop the development of cold fusion, and since they are working with hundreds of billions of dollars, their influence will be felt via all levels of government, federal and state, through our universities, and the financial markets.

This presents both one whale of a problem, and an opportunity.

As I've pointed out before, it was the stubbornness of the established computer industry that allowed the personal computer to come along and blindside it, giving us Bill Gates and a few other new billionaires (mostly college dropouts, by the way). Can some enterprising newcomers blindside the oil and power companies? I believe they can.

Fortunately there are very few people who have somehow escaped or avoided the establishment way of living,

so this new technology presents a great opportunity for these winners. Most people are totally buried in working at jobs and being entertained the rest of the time. Ball games, sitcoms, TV talk shows, 100 channels of garbage, rock 'n' roll, fast food, coffee and Danish, Coke™, and so on. Almost everyone you know is buried in this crap and unable to be motivated to change. Well, these are *not* likely to be the entrepreneurs who are going to be our new billionaires. The PC has generated new billionaires such as Gates, Allen, Jobs, McGovern, and Ziff, so let's see who the new cold fusion billionaires will be. I don't need a new career, but how about you?

Mooned!

My wife, Sherry, enrolled in a video production course at a local college. One part of the course called for the students to do a short documentary on some subject. So she decided to do hers on René's book, *NASA Mooned America*. She read the book again, then read Kaysing's *We Never Went To The Moon*, and Brian's *Moongate*. She then got all of the videos and books she could locate on the Apollo missions and went through everything carefully.

Did the data presented in the books by René, Kaysing, and Brian hold up? Sherry was amazed to find that though the Apollo astronauts supposedly took thousands of photographs, that there were only a dozen or so which were available, and that these same few photos were used in all of the books.

Then she watched the videos and was amazed. In several instances, where both of the astronauts were supposedly walking on the moon, the camera somehow managed to pan all by itself, following their action. Say, who was operating the camera? Then, when the LEM was taking off, the camera panned upward, following it. How'd they do that? Radio control from Earth? Not likely, considering the several-second delay for radio transmissions.

Oh yes, that radio delay. In several instances in the videos they had the astronauts on the moon talking with Houston, and there was no delay as they talked back and forth! That's not only impossible, but represents very shoddy technical directing.

None of the moon videos or photographs show any stars, yet that's the first thing our early astronauts in space commented on. They were amazed at how incredibly bright the stars were.

I suspect that the difficulties of showing the stars in their right places and with their correct brightness from the vantage of the moon's surface was beyond their technical ability in the 1960s, so they just had to leave them out and use plain black backdrops.

I did enjoy one short scene where we could see a reflection in the face plate of an astronaut supposedly on the moon which showed what sure looked like someone sitting at a video console in the background. I suspect Sherry will be using that in her documentary.

Many of the video scenes showed moon dust being kicked up and footprints in the dust. Yet scientific experiments at North American Aviation have proven that it takes an atmosphere to have dust blow around. When you remove the air from dust it becomes like brick and you can bounce a steel ball off it.

There was one other scene in the moon video that got Sherry laughing. The two astronauts were showing how high they could jump in the one-sixth-Earth's gravity. The funny part was that they did this from behind something which obscured them both from the waist down so that you couldn't see the trampoline which must have been hidden there. Even so, they weren't able to jump any higher than we would expect on Earth.

I suspect that the other students in the class, who are doing documentaries on things like how they wash their socks, will be surprised when they see Sherry's video.

Why did NASA fake the Apollo missions? 1. President Kennedy, with the assurance of NASA, said we'd put a man on the moon before the end of the 1960s. 2. Congress budgeted $40 billion for it. Then, when it became clear that doing it was beyond their ability for several reasons, NASA had to decide whether to lose the $40 billion or fake it. Well, that's my scenario, so let's see what happens next.

The next big problem for NASA was that damned face on Mars we've all seen ballyhooed in the tabloids. If it turns out to be clear evidence that it is not a natural phenomenon, then the pressure will be on for sending men to Mars to take a closer look — which NASA *still* can't do. The only practical alternative for the NASA top people has been to prevent more photos of the face being taken.

Remember that Mars observer NASA sent a couple of years ago. Golly, it sort of disappeared, according to the NASA (Never A Straight Answer) releases. But several NASA engineers have reported that the satellite is there and working just fine, according to Richard Hoagland. The recent NASA release saying that the new Mars Observer satellite won't be able to photograph the Sidonia region, where the face is, was not a surprise.

Hoagland then went on the Art Bell talk show and got thousands of Art's listeners to FAX Golden, the NASA head, pushing for the photos to be taken and released. So we'll see what happens. Maybe.

If this whole subject is of any more than casual disinterest to you, you could do worse than read Jim Marrs' book, *The Alien Agenda*. It seems that a surprising number

Continued on page 78

LETTERS

From the Ham Shack

David Black KB4KCH supplied *73* readers with a copy of the following letter he sent to ARRL President Stafford, via *QST*.

To Mr. Rod Stafford W6ROD, ARRL President: As I write this, residents of central Alabama continue to dig out from the Oak Grove tornado, the worst such storm to strike the state in more than half a century. The April 8th tornado, packing winds estimated at more than 260 miles an hour (making it a Category 5), ripped a 30-mile path of destruction through residential areas near Birmingham around 8 p.m. More than 30 people died.

Several officials described the destruction as the worst they had ever seen. Federal disaster declarations followed quickly. Vice President Gore, along with James Lee Witt, Director of FEMA, toured the area, and President Clinton is scheduled to arrive in less than 24 hours to visit the disaster scene (at this writing).

We note with great pride the major role Alabama radio amateurs took before, during and for several days following the tornado's violent attack. Before the storm hit, amateurs across north and central Alabama (who regularly take part in the local Skywarn network) had already been on the air nearly nine hours, relaying important storm-related messages to assist the National Weather Service in Birmingham. The NWS later said of the amateurs, "We couldn't have done it without them." As the tornado hit, more frequencies were pressed into service for disaster relief and additional storm spotting needs. At one point, more than half a dozen VHF and UHF repeaters in the Birmingham metro area were used in some capacity either for the weather emergency itself, EMA operations or for storm report relays. Valuable reports were also received via an Internet/packet radio gateway developed by hams. In the third phase, still more radio amateurs remained on the air in the disaster zone for several days, assisting with relief communications to assist the hundreds of people displaced from their homes. Members of a federal disaster survey team sent to Birmingham were reported to be planning to interview local radio amateurs who provided Skywarn communications services during the crisis. In short, central Alabama was rocked by a disaster of a magnitude rarely experienced. Birmingham was the subject of extensive coverage, much of it live, by the nation's broadcast networks and other news media. Amateur radio operators were among those receiving prominent and very favorable coverage for their efforts. It is important to point out that the radio amateurs participating in the many aspects of this emergency did not come from any one group. Some are individuals. Many are members of various amateur radio emergency communications groups and some radio clubs all across the state. Within these groups, many individuals hold League affiliation. While the hams responding to this disaster came from diverse groups and backgrounds, they held in common a commitment to pull and work together, using their communications skills to help a community shattered by tragedy try to get on its feet. While many of the amateur operations were conducted in an ARES mode, none of the hams working the disaster cared for a second what group other hams were affiliated with. If they were on the air helping, they were simply part of a team effort. This philosophy is not unique to the April 8th tornado. Rather, it has become commonplace as emergency communications groups all across Alabama have been actively working more and more closely with each other during the recent past to achieve common goals.

Today, on this, the sixth day since the storm hit, we note—with astonishment—the League's failure to utter so much as a word in any bulletin or advisory to its members about any of the efforts of Alabama radio amateurs in the disaster. This blatant inaction comes despite submission of reports on the hams' activities to the League by four individuals (including myself). Some of the information was sent to Newington within a few hours of the tornado's touchdown. Though my submission was never acknowledged, I know for a fact it was received. Fortunately, arrival of the Internet means that hams no longer have to rely on the League to disseminate important information to the amateur community. Our amateur radio group's interactive Web site (http://bandmaster.com/alert) has been a source of extensive news coverage involving the tornado and the role hams played. We gratefully acknowledge other amateur radio news media that aired news of the disaster within a day of its occurrence. I am reminded of your August, 1996 *QST* editorial in which you praised the merits of being involved in public service communications. There is a place for everyone, you told readers, adding, "Naturally, we want you to participate in ARRL-sponsored programs such as ARES and NTS, but this is subsidiary to the main point: Participate in any way that's right for you." It is no secret that more and more radio amateurs today feel an increasing distance between their interests and concerns as hams and those held by the League and its hierarchy of Directors who dictate so much policy. This latest incident does nothing whatsoever to improve that image. I have a more than 10-year history as a League member, including serving as a Public Information Officer and Public Information Coordinator. In 1997, I was honored to be recognized as Ham of the Year by ARRL Alabama for my work in the Skywarn program. In the past, I have defended the ARRL on more than one occasion, saying, in effect, "Newington really does care." The League's pathetic lack of acknowledgment of Alabama radio amateurs for almost one week now strongly suggests that I was wrong and reeks of politics. This is no accident. The League's leadership has chosen not to acknowledge the valiant efforts of so many, apparently because the entire operation did not fall under the ARRL "umbrella" of dominance. League members are the ones who suffer from being denied access to information as a result of this blatant arrogance. When the day comes that the League's Directors as a whole acknowledge that the ARRL does not, and cannot, speak for every amateur when acting in such an elitist way, the ARRL will be at the starting point of regaining some of the credibility it so badly needs among the growing number of active hams who choose not to be League members.

I am very proud to be affiliated with the Alabama amateur radio operators who responded to the April 8th disaster even if the ARRL couldn't care less. And I don't care what group they were members of. The League's refusal to even merely acknowledge what these people did during the first few days is incredible, regrettable and is a slap in the face to every one of them. In short, every League official with any role in the decision not to recognize hams during the Oak Grove tornado should be ashamed. Sincerely, David Black KB4KCH, President, Alabama Emergency Response Team (ALERT).

As a 60-year ARRL member I've probably been making a nuisance of myself over the

ARRL's ancient Board's management of the organization, making the League seem to the majority of ham newcomers as irrelevant to both them and the 1990s. Hey, up there in your moat-protected ego-built castle, wake up! We hams are hams because we're different from everyone else. We don't like to be treated like sheep and we won't stand for it. If the ARRL Board wants the League to represent us amateurs, then they'd better stop being all mouth and no ears ... Wayne.

Kenneth E. Stone W7GFH. Thanks for running my letter and circuit schematic for my bioenergizer (see April 1998 "Letters"). I notice that the correction I sent didn't make it to the circuit. The timing capacitor and resistor connections should have the common terminal as 3 instead of 1 and the capacitor is connected to pin 1 instead of 3.

I have made a further improvement (**Fig. 1**) on the circuit I use at home. I removed the 100 k current adjust pot and added a solid state current limiter circuit in one of the output leads. The limiter uses four switching diodes, such as 1N914, in a bridge rectifier configuration and an LM334 current limiter with a fixed 270-ohm resistor and a 5 k pot in series to adjust the limiter current. By using a true RMS DMM the limiter potentiometer can be calibrated to provide an actual known output current, assuming you use low resistance electrodes. With the 270-ohm fixed resistor the maximum output will be about 250 µA. Using this addition allows you to know the actual current—which I find mentally satisfying, even if not really needed.

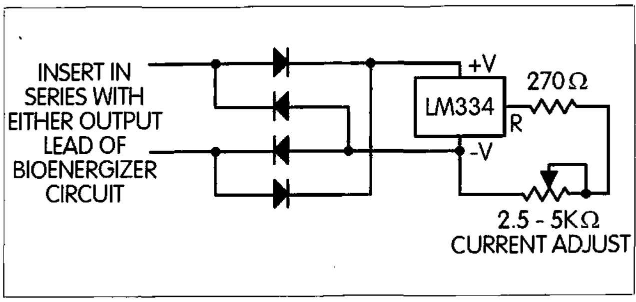


Fig. 1. Another "improvement" for Tom Miller WA8YKN's Bioelectrifier™.

Jack Burton WA6TDU. Hi, Wayne, I have been following your editorials in *73*, particularly subjects concerning health (I'm a 22-year Navy retiree and a 32-year aerospace electronics retiree).

Somehow I missed the first of the Bioelectrifier articles, but last year I built the one designed by Tom Miller in the May 1996 *73*. It works very well but I believe that I have simplified it further with some of the suggestions in that article. See **Fig. 2** and **Photo A** of my simplified version. Note that the oscillator is a three-volt version, which is adequate to switch the 4N37s. Kudos to Mr. Beck and Mr. Miller, and keep up the hassling!

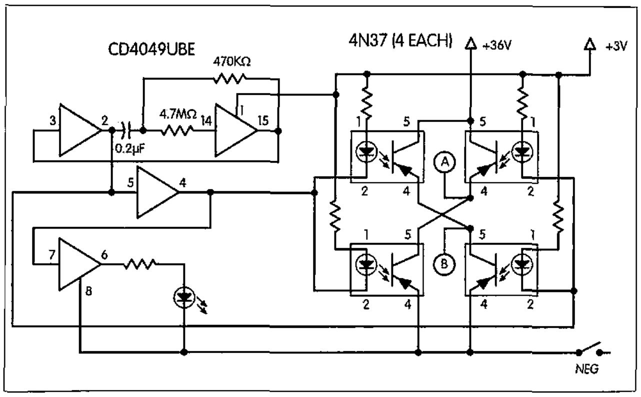


Fig. 2. Yet another "improvement" of the Bioelectrifier.

Chris White KD3SR, Charleston SC. I am writing in response to Jim Kocsis' article "Noise Surgery 101." Jim has a few good ideas about reducing RF noise from your PC, but there are a couple of things I would like to add to his article.

First, while Jim does mention taking care while removing cables from the motherboard, he really should stress this point more. Many cheaper motherboards—the ones most likely to be noisy in the first place—are fairly thin and *fragile*. Repeated stress on any motherboard connector can cause board traces to crack, resulting in a useless computer.

Next, since some motherboards are so fragile, care must be taken when removing them. Bending and dropping are obvious no-nos, as is lack of a wrist strap to prevent static discharge from your hands from damaging the board. But just as important is where you store the motherboard when you are making your modifications. It needs to be in a clean, dry place, where it won't get kicked off the kitchen table or stepped on by the family pet. Static charge on the surface you store it on can also harm the motherboard, so an anti-static mat, conductive foam, or anti-static bag are best for storing your motherboard if you can find them.

One thing Jim didn't mention is metal shavings. Your case modifications will make a lot of them. Any left behind in the case could cause your motherboard to short out. Then you would have proof of the smoke theory of electron movement! Clean these out of the case as best you can before re-installing any components.

An alternative to the wire-brushing is to use star washers. Cinch them down until just snug, then another quarter turn. Now twist them back and forth a few times, until you can see bare metal through the tines of the washer. Remove the washer and clean the paint from its tines. When you reinstall it, you should have good contact to the chassis of the computer.

When re-installing the motherboard, it is important to ensure you *do not* overtighten the screws.

The metal screen Jim suggests for use over the fan outlet can be improved some. The

Continued on page 78

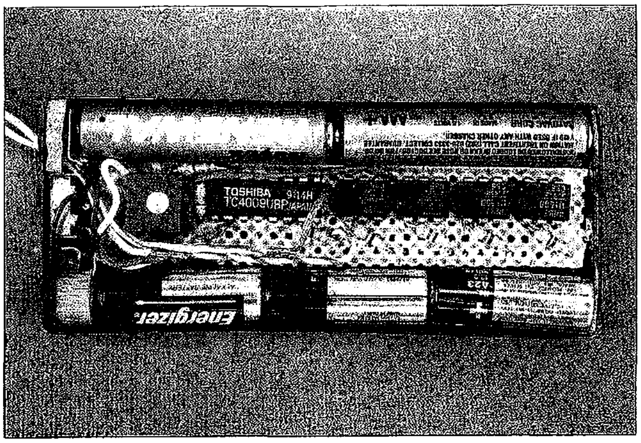


Photo A. WA6TDU's simplified version.

Number 8 on your Feedback card

QRX . . .

Asteroid Named After Ham

In addition to his interest in ham radio, Warren Offutt AF9Q, of Cloudcroft, New Mexico, has a deep interest in astronomy and gained considerable renown as an amateur stargazer. His name is now up in lights—in a manner of speaking—in the form of an asteroid some 350 million miles from Earth.

Offutt said he learned just a few days before his 70th birthday that the International Astronomical Union was naming a minor planet in honor of his scientific contributions. The asteroid will be known formally as Minor Planet (7639) Offutt. Estimated to be several miles in diameter, it orbits the sun in the asteroid belt between Mars and Jupiter.

Over the past year, Offutt has helped in three major discoveries from his home observatory. He reports that his and his wife's confirming observations of one of the newly discovered moons of Uranus appeared in the British journal *Nature*.

Offutt, an ARRL member licensed in 1943, says his 55 years of hamming have been a wonderful experience: "I still get a thrill out of each new contact."

The Offutts have 10 children, three of whom are hams.

From *The Modulator*, newsletter of the Fort Myers ARC, March 1998, Earl Spencer K4FQU, editor.

Hams Off the Great Circus Train

A Wisconsin ham radio tradition of more than 30 years has come to an end. Ham radio has been bumped from the annual run of the Great Circus Train. The train runs each summer between Baraboo—where the Ringling Brothers Circus got its start in 1884—and Milwaukee, the site of the annual Great Circus Parade. ARES members rode the rails to help handle communication along the route and, once in Milwaukee, at the show grounds and for the parade itself.

In a letter to Bob Goldstein K9KJT, of the Milwaukee ARES group, the train's sponsors, the Circus World Museum, cited "severe space limitations" on the coaches for their decision to drop ham radio in favor of an offer of free commercial digital and analog service from PrimeCo. "We are attempting to eliminate as much clutter from the train coaches as possible this year and open up more space for our passengers," the museum's letter read.

Ham radio first came aboard the circus train in 1965 when ARES member Don Evenson K9JYX set up a VHF station that relayed to an HF mobile station chasing the train. In 1994, onboard HF operation was added. Wisconsin ARRL PIC Jim Romelfanger K9ZZ—an indefatigable circus train booster—reports that over the past two years, hams aboard the circus train worked an average of 225 stations during the run, and fielded some questions about the circus at the same time. He said that without ham radio, the circus events and the museum would lose a tremendous public relations benefit that cost nothing. Romelfanger says he met a lot of the state's shakers and movers over the years through his association with the train. One time, he said, Ted Mack (of radio and television's "Amateur Hour" fame) rode the train and was interviewed by Evenson.

This year, the National Governors' Conference is in Milwaukee in late July. The train runs the last Monday and Tuesday in July, and the parade is August 3, Romelfanger said.

He added that the museum's decision surprised and puzzled him, and he expressed disappointment that the circus train would not carry amateur radio this year, when Wisconsin marks its sesquicentennial. "It was a privilege to work for the museum, the train, and the parade," he said.

From the ARRL, via *Tuned Circuit*, May 1998, Dave Herrington N8NLK, editor.

Field Day Lessons Learned

• Have comfortable operating chairs. Lawn chairs just don't hack it.

• Phone bands should have full headsets with boom mike and a footswitch.

• Digital voice keyers (DVKs) are a real plus when the bands are not so active. Check them out *before* Field Day begins.

• If you have an automatic antenna tuner in your rig, use it even if you already have a good SWR. It will cut down on the interference.

• Get a clear frequency, call CQ, and run 'em. Tuning around and pouncing is *not* the preferred method.

• Computers must have a 3-1/2-inch floppy drive.

• Set computer clock to UTC, and make sure band is correct.

• Save log periodically (at least every two hours).

• Check out antennas beforehand, and make contacts before Field Day starts.

• Set up your station on Friday afternoon.

• Band captains should plan to have backup ops scheduled to operate even during off-hours of propagation.

• Be prepared for scorching heat, numbing cold, torrential rains, and full sunshine.

Yes, you've heard it all before—but it's still good advice!

From *Wireloose*, May 1998, newsletter of WWI, Woodbridge, Virginia.

More on Morse

The Radio Society of Great Britain says that it no longer supports mandatory Morse code testing for access to the amateur bands below 30 MHz, according to several sources in the UK. The national society will lobby the IARU to try to get a rules change passed at the 2001 World Radio Conference to support the abandonment of the international statutory requirement for Morse testing.

The change in policy by the RSGB comes only 18 months after its December 1996 announcement of the results of a survey on the future of amateur radio in that nation. At that time, 30% of the society's members responded. Two thirds said that Morse code should remain as an international licensing requirement.

The same sources say that the RSGB will propose to the nation's radiocommunications agency that a new class of ham license be introduced in the United Kingdom, one that will give all amateurs access to the HF bands below 30 MHz by passing a very simple slow-speed CW test—possibly as slow as 5 wpm.

Via *Newsline*, Bill Pasternak WA6ITF, editor.

Reciprocity Approaches

US amateurs soon will not need to apply for reciprocal licenses in order to operate during short visits to most European countries. Although at this writing an official announcement had not been made, the US request to participate in the European guest license arrangement has been approved; similarly, most European hams visiting the US no longer will have to submit FCC Form 610A.

In September of 1997, the US State Department applied for US participation in the European Conference of Postal and Telecommunications Administrations (CEPT) amateur radio licensing system. A holder of a CEPT license can operate in CEPT-participating countries without having to apply for a reciprocal license.

Approval of the US request came in late January 1998, at a meeting of the CEPT Radio Regulatory Working Group (WGRR), in Groningen,

Continued on page 49

Raising the RASER to New Heights

A two-element beam for 80 meters.

James E. Taylor W2OZH
1257 Wild Flower Drive
Webster NY 14580

Because of the unique effectiveness of this antenna system, a number of the hams I have talked with have asked me to put the construction details into an article. This article, therefore, is directed to those who wish to duplicate the system without complicated formulas or computations. This is offered as a fun project which teaches some advanced understanding of antenna theory as well as some practical assembly experience.

In the past, I have successfully used conventional two-element phased-array beams on the 80-meter band. These were composed of two parallel resonant dipoles, spaced one quarter-wavelength apart, horizontally, and fed at their centers by coaxial cable. The pattern direction was reversed by throwing a switch. This changed the length of the feedlines, initially equal, so that one feedline was one quarter-wavelength longer than the other. The phase shift introduced by this "quadrature" delay results in reinforcement of the radiated signal in this direction with a corresponding cancellation or null in the opposite direction. Thus, we have a beam antenna with the ability to switch directivity, for example, from east to west! The phased array featured in this article has still greater gain, accomplished by replacing the dipoles in the former design with longer dipoles called RASERs.

I first wrote "The RASER," published in *73*, September 1992, and "The RASER Revisited," *73*, October 1993 (both of those articles can be viewed on the Internet at [http://home.att.net/~JETAYL/w2ozh.html], along with additional comments). As I described in those previous articles, the development of the RASER gain dipole was derived from prior work by Harry Mills W4FD.

(Note: I have chosen the term "RASER" for the novel structure, due to its remote similarity to the LASER—both use coherent radiation to obtain gain. Also, in the past, the acronym CCD for Controlled Current Distribution has been used. Because that term is now almost universally accepted by engineers to mean Charge Coupled Device, I will be using what I hope is a less confusing term, DCR—for Divided Current Radiator.)

The RASER approach

Let's go back to general principles: If we consider a short length of wire carrying RF current, it has an inductance which can be readily calculated; see **Table 1**. If the current is to be essentially constant along the wire in each DCR, its length must be a small fraction of a wavelength—for example, 1/50th.

RASER Parameters

Assumed Frequency	3.953 MHz
Initial Terminator Length	59 feet, 2-1/4 inches
Wavelength	249 feet
1/50th Wavelength	~5 feet
Calculated Self-Inductance of DCRs	2.15 µH
Capacitance for Resonance	~750 µF
Empirically Determined Optimum Values	
DCR Length	57 inches per section
Reduction of Terminator per DCR Section	~2.21 feet

Table 1. RASER parameters—calculated and empirical.

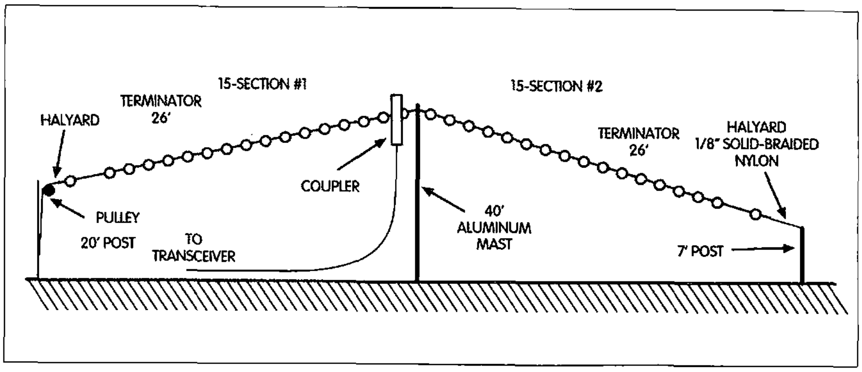


Fig. 1. Balanced 30-section RASER (centerfed).

This length could be increased with a corresponding decrease in the number of DCRs required. For a chosen frequency, the value of series capacitance required for resonance can then be calculated. At this frequency the tuned circuit is, of course, nonreactive; that is, it acts like an element of radiation resistance with only the mutual inductance between DCRs remaining. If we place several of these tuned DCR sections in series, as in **Fig. 1**, their currents will be in phase and the resulting radiation will be coherent, i.e., mutually reinforcing. The result is a *stretched* resonant radiator. Let us now place a number of these DCR elements at either side of the center of a dipole, and trim the structure of resonance by adjusting the lengths of the capacitive terminating wires at its ends. This RASER concept offers gain over a half-wave dipole antenna due to the increased aperture and the coherent radiation from the resonant DCRs.

Construction

Let me review, briefly, the construction of RASER gain-dipoles for the 80-meter band, and also the extension of the idea to a two-element phased array with switchable directivity. A tabulation of values for other amateur bands is included. Also, please note that the quarter-wave delay line has been replaced by a simple pi-section phase-shifting circuit. The centerfed configuration will be emphasized here, although the endfed RFD arrangement has proven to be equally effective (see "RFD: Resonant Feedline Dipoles," *QST*, August 1991).

The RASER dipoles

The installation at my QTH has a single RASER dipole as shown in **Fig. 1**. Each RASER is composed of 30 DCR sections (see **Fig. 2**), with 26-foot wire terminating stubs at each end. Each RASER is fed with 52-ohm coaxial cable through a coupler unit placed at its center (see **Fig. 3**). The coupler unit is a bifilar-wound, toroidal impedance-matching transformer tapped at 26 turns and enclosed in a plastic box.

The RASERs are tuned to resonance at the desired frequency by pruning the lengths of the terminators symmetrically. The desired 1:1 SWR was obtained by changing the tap position on the transformer. An antenna impedance bridge is useful in this adjustment—I used a Palomar noise bridge. The overall length of each RASER radiator, some 200 feet, was determined solely by my site restrictions, as was the height above ground. The geometry can be changed to match other site dimensions by changing the number of DCRs, the lengths of the terminators, and the position of the tap on the matching transformer. Greater lengths of the RASER will increase gain up to the point where cumulative phasing errors diminish coherence of the radiation from the DCR sections. The height should be as great as possible for best efficiency of radiation.

Configuration of the RASER phased array

As shown in **Fig. 4**, I fabricated and installed two identical RASERs, horizontally spaced approximately one

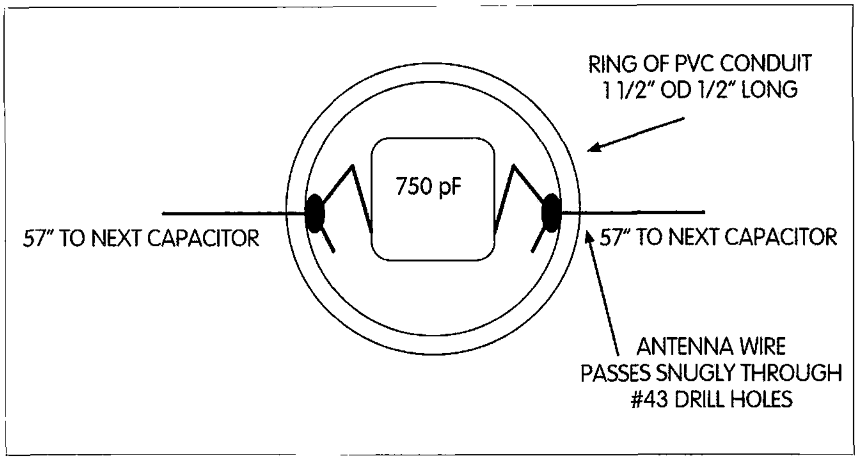


Fig. 2. Capacitor assemblies in the DCR.

quarter-wavelength, or about 60 feet, along the perpendicular horizontal line through their centers. The initial feedline lengths are made equal. These lengths can be randomly chosen, although it is useful to use an integral multiple of a half-wave *(in the coax)* in each to minimize reactance effect. I found it convenient to use two lines, each of which is one wavelength long, or about 180 feet. The switching of direction of radiation is accomplished by the use of a multisection, wafer-type selector switch. An impedance matching transformer is required to correct for mismatch at the input to the feedlines. See **Fig. 5**, T1. As mentioned, instead of using the quarter-wavelength delay line to provide the required quadrature delay, I found it expedient to use a simple pi-section phase-shift network as shown in **Fig. 5** (L1, C1, and C2).

The operation of the system is more readily understood by referring to the schematic diagram, **Fig. 5**. If the selector switch is thrown to the dial position marked BEAM EAST, power from the transceiver is switched to the input of the impedance-matching transformer T1 through capacitor C3. This provides the small capacitive reactance necessary to compensate for the inductance of the transformer winding. The output from this transformer, at lowered impedance level, is fed into the pi-section phase-shift network, L1, C1, and C2. The unmodified signal at the input to the network is switched to the WEST RASER. The quadrature shifted output is switched to the EAST RASER. As mentioned earlier, this phase shift produces an antenna pattern with gain in the east direction and with cancellation in the west direction. Following the diagram, conversely, when the switch dial points to BEAM WEST, the pattern will be directed to the west.

Additional switch positions have been provided so that we can select either of the two RASERs separately. This capability is useful for comparison purposes. Two connectors are provided for the horizontal and vertical plates of an oscilloscope to present a lissajous figure. This is useful for checking phase shift and for monitoring operation of the system. Also, a separate switch position is provided for an external dummy load. Two coaxial connectors are provided (marked OPTIONAL DELAY-LINE INPUT and OPTIONAL DELAY-LINE OUTPUT) for use if an external quarter-wave delay line is desired instead of the internal phase-shift circuitry. To achieve this, the circuit is broken at the three points marked X, effectively eliminating the components L1, C1, and C2.

Please refer to the schematic diagram, **Fig. 5**, and to its notes, **Table 2**. The switch, the toroidal matching transformer, the phase-shift circuitry, and the sockets required for all of the coaxial cable connections are housed in a metal chassis box. I used a three- by five- by seven-inch aluminum box, although any one sufficiently large to accommodate the parts will be satisfactory. As any experimenter will agree, you are wise to install extra coaxial connectors for possible future experiments. **Table 3** is a simplified parts list for the system.

Adjustment of the system

The two RASER gain-dipoles in the beam are separately adjusted for resonance using the noise bridge. For these resonance adjustments, the selector switch is alternately in the EAST RASER position, then the WEST RASER position. During these measurements, the feedline of the unused RASER is disconnected at the switchbox and terminated at its input with a noninductive 52-ohm carbon resistor. This is used to simulate the cross-coupling between the two RASERs during operation. After the separate radiators have been adjusted to resonance by trimming the lengths of the terminator wires, and the match has been set by adjusting each coupling unit, the beam is ready for on-the-air use. If the option of using a quarter-wavelength of coax is chosen, no further adjustment is needed.

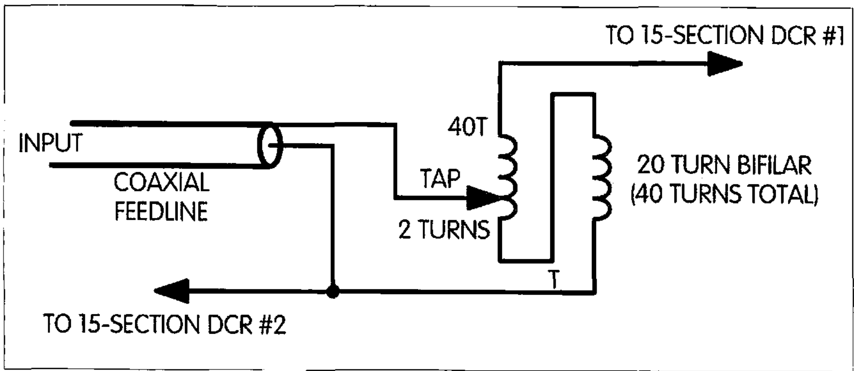


Fig. 3. Coupler unit schematic (centerfed).

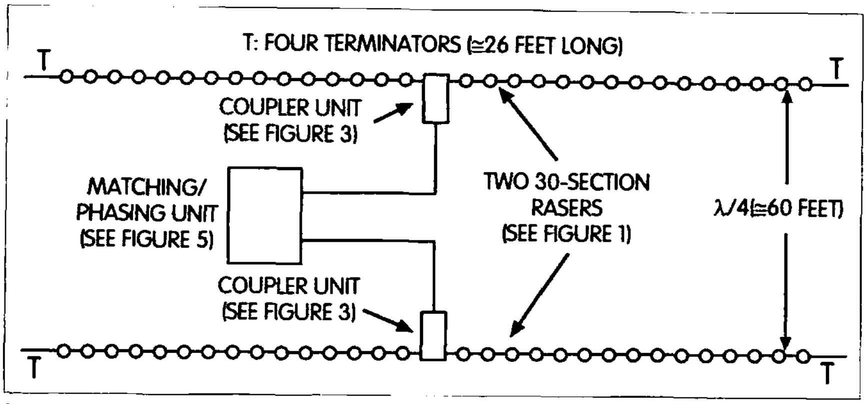


Fig. 4. RASER phased array (viewed from above).

However, if the pi-section phase-shift network has been chosen instead of the coaxial delay line, it will be necessary to optimize the values of the inductor L1 and the capacitors C1 and C2 for optimum phase-shift between the two RASER radiators. If the inductor has been fabricated as described, probably no readjustment of this component will be required. The values of C1 and C2 can be readily adjusted by use of a split-stator air capacitor, since these are nominally equal capacitors. The adjustment is made by viewing the lissajous pattern, or by measuring received signal strengths. The capacitors are then adjusted for the most symmetrical elliptical scope pattern or for optimum signal strength and front-to-back ratio when the direction of the antenna pattern is switched from EAST to WEST. Ideally the patterns would be perfect circles, but actually this is seldom achieved because of cumulative differences in the parameters of the antennas. These may be due, in part, to site variations and differences of component values. Bill Shanney W6QR has modeled the RASER beam using the EZMEC 1.0 program. The resulting charts strongly reinforce my experimental results. Contact Bill by E-mail at [wshanney@earthlink.com] for more information.

Extensions to other bands

As pointed out, the lengths and other parameters mentioned above were

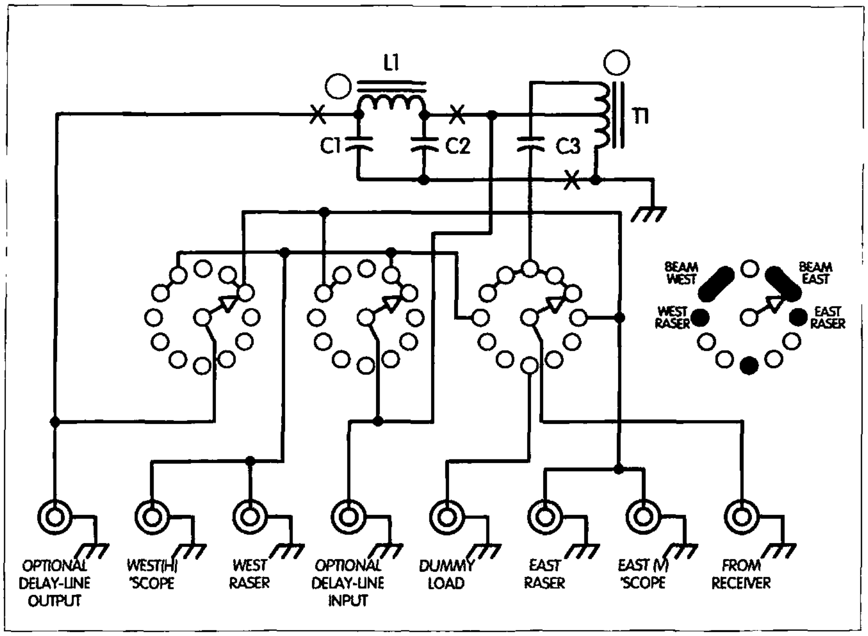


Fig. 5. Two-RASER phased array switching/phasing unit.

Notes for Schematic, Fig. 5 (parts details)

L1	10 turns #12 enameled copper wire wound on approximately 1/4 of the circumference of an Amidon T-200-2 powdered iron core
T1	8 turns, bifilar, wound on Amidon T-200-2 powdered iron core, tapped 4 turns down from the ungrounded end (8 + 4 turns up from the grounded end)
C1, C2, C3	Silver Mica, or equivalent C1 = 857 pF C2 = 848 pF C3 = 953 pF (for resistor loads) C3 = 803 pF (for 30-section RASERs)
Switch	3-gang, multipole selector switch: I used a Centralab Type 2017 with contacts paralleled

Coaxial sockets shown are SO-239 (8)

***Table 2.** Notes for **Fig. 5**.*

chosen for the band of principal interest, 80 meters. However, in response to a number of requests, I have calculated approximate values of DCR lengths and capacitances for the HF bands as shown in **Table 4** (the lengths of terminators and tap position on the transformer are best determined through experimenting after a rough estimate by scaling to the frequency).

Parts List

Qty.	Description
425 ft.	7X #22 stranded copper-clad antenna wire
400 ft.	RG/8 coaxial cable
2	4" x 2-7/16" x 1-1/16" plastic boxes
1	3" x 5" x 7" aluminum chassis box
1	2017 3-gang multipole switch
Assorted	Silver mica caps, 50 pF to 1000 pF
60	Silver mica caps, 750 pF, or equivalent
2	T-200-2 powdered iron toroid cores
8	SO-239 Coaxial sockets
10 ft.	2 x #20 Parallel bell wire
Foam epoxy potting compound	

***Table 3.** Parts list.*

The gain of each RASER is directly dependent upon the number of DCR sections used, so the more sections the better! The 30 elements in my two-element array work just fine!

Results

The two-element RASER phased array has been in operation at W2OZH for several years now with outstanding results. I have consistently received reports of superior signal strength from both east and west directions, as expected. I call many CQs using a single gain-dipole and have had almost no answers from the more distant northerly and southerly locations. This is to be expected if the pattern is mainly east and west as designed. As might be expected for the variations of propagation conditions encountered on 80 meters, the front-to-back ratios, measured on either received or transmitted signals, vary considerably with time of day and distance. However, a ratio of 25 decibels is commonly experienced and I have frequently measured a front-to-back ratio of 35 decibels—equivalent to a power ratio of some 3000 to one! This ratio is even more impressive when we realize that the signal strength of a station running the legal limit of power to the rear of the beam is reduced to sound like a half-watter!

One dramatic dividend from the use of a beam on the lower frequency bands is the obvious reduction of QRM, especially during the crowded evening hours. For example, if I have the pattern pointed to the east, I can readily work stations in that direction without either hearing or interfering with same-frequency stations to the west.

I wish to acknowledge the encouragement and assistance of many hams who have shown interest and who have patiently given signal strength comparisons for the numerous experimental arrangements which led to this final design.

RASER Scaled For Other Bands

BAND (m)	FREQ (MHz)	DCR (in.)	L (μH)	C (pF)
160	1.9	118.6	5.33	1250
80	3.954	57	2.15	750
40	7.263	31.03	1.10	430
20	14.29	15.77	0.40	310
17	18.14	12.42	0.31	250
15	21.38	10.54	0.29	185
10	28.65	7.866	0.21	150

***Table 4.** RASER scaled for other bands.*

Build This Simple CW Identifier

You, too, can program EPROMs.

Rudolf F. Graf KA2CWL
111 Van Etten Blvd.
New Rochelle NY 10804-2321

William Sheets K2MQJ
P.O. Box 200
Hartford NY 12838

The CW identifier (ID) has a number of uses, from automatic identification of repeaters, transmitters, and beacons, to performing repetitive CW chores such as calling CQ. An identifier is a device that generates a preprogrammed message of some kind, generally a callsign and possibly additional data such as the geographical location or status of the transmitter with which it is used.

An identifier can be set up to generate a message either on command or continuously, depending on application. There are several approaches to the circuitry, and these may involve anything from simple mechanical keyers, a tape-recorded audio tone driving a keying relay, or a purely digital approach that generates the required keying waveform from a programmed memory of some sort. A microprocessor can be programmed to generate the desired message, but if no other control, monitoring, or data transmission features are needed, it is easier to simply read out a message stored in a memory such as an EPROM.

We had a requirement for a simple ID circuit for an experimental beacon transmitter system currently under construction. We needed to generate a keying waveform that would include callsign and grid square, together with a short carrier for tuning purposes, that would be continuously running. In addition, simplicity and low cost were desired. A circuit evolved using a 555 timer running at the baud rate and feeding a counter that addresses a CMOS EPROM.

The message can be programmed into the EPROM with an EPROM programmer. Our programmer runs off the lab PC; its DOS-based software makes the programming a breeze. It connects to a second parallel port (LPT2). If you do not have a programmer and/or a PC, the EPROM can be manually programmed via a simple circuit consisting of a pulse generator and a few SPDT switches. See the EPROM manufacturer's data sheets for the exact procedure. In many cases, these can be found on the Internet and downloaded free of charge.

EPROMs have become cheap and easily available. Even a long-winded ID sequence will fit into the smallest of them. The smallest commonly available EPROM today is the 2716, which is a 16 K-bit unit. The memory is arranged in bytes, so there are 2048 bytes (eight bits). However, there seems to be no correlation between price and size. The 2764 is usually cheaper, as it is common in surplus; we used the CMOS version, the 27C64, which is also fairly common.

If you use a surplus part, make sure it is erased clean (all bits logic one) before using it. You can use an EPROM eraser or a strong UV lamp to do this, or else try leaving the EPROM with its window uncovered in strong sunlight for a few days (not very practical here in the northeastern US!). Otherwise, use a new part.

The desired code is programmed into the EPROM one byte (eight bits) at a time. We used a logic high (again: an erased, "clean" EPROM has all bits at logic high) as a space and a logic low as a mark.

Memory Location (Hex)	Data Bits								
	0_7	0_6	0_5	0_4	0_3	0_2	0_1	0_0	
0019									
0018									
0017									
0016									
0015								■	Counter Reset
0014									
0013									Space
0012									
0011				■				■	
0010									
000F				■				■	
000E									
000D				■				■	"B"
000C									
000B				■				■	
000A				■				■	
0009				■				■	
0008									
0007									Space
0006									
0005				■				■	
0004				■				■	
0003				■				■	"A"
0002									
0001				■				■	
0000									Space

***Table 1.** EPROM programming scheme. Only O4 and O0 are used. Space (white) = logic 1. Mark (black) = logic 0. Gray = don't care (logic 1 or 0). An erased EPROM has logic 1s at all locations. Memory map shows message AB programmed into locations O4 and O0. Counter reset requires O4 to be space. O0 to be mark. Leave first location as space to avoid longer cycle that occurs on first oscillator cycle after powering up.*

However, a little thought can save some circuitry and programming effort. Normally, each bit is addressed sequentially. This will require circuitry at the EPROM output (which is eight lines per address) to select each bit, zero through seven, in sequence. But we have 8192 addresses, so why not use only one bit per byte and ignore the rest? This saves circuitry and will simplify programming. One other bit can be used to signify the end of the message and to reset the counter once the last needed address is reached.

Wasteful, yes, in terms of memory utilization, but we have far more than we will ever need anyway. We used the bit four as the programmed output and bit zero as a control bit. When bit zero—normally the same as bit four—is different from it, this condition can be employed as an end-of-message marker and used to reset the counter back to zero, starting the cycle over. Of course, any other two bits can be used as well.

Morse characters are formed from dots and dashes. Generally, a dot is considered as a unit length. Then a dash is three (but may be up to five) dots in length, and dots and dashes are separated by the length of a dot. Letters are spaced generally at three to five dots, or the length of a dash. Words are spaced somewhat further, five dots or so. These are a matter of individual preference, but longer dashes are somewhat easier to read at very slow (less than five wpm) CW speeds, as the dots may be made shorter for a given speed. This is also somewhat more "comfortable" to read and avoids the dots being at first mistaken for dashes.

Wider spacing between individual letters with correspondingly faster transmission speeds for individual letters is sometimes used. This makes for better copy by CW operators who are used to faster speeds. (When you are used to normal 18–25 wpm QSOs, five wpm can be a bit tedious to copy.)

We found that a ratio of three to one sounded best at the 10 wpm speed intended, and adopted a spacing of one dot between dots and dashes, and three dots (one dash) between letters. However, this is a matter of individual preference.

The EPROM is programmed sequentially depending on the desired message. A given address location is programmed all ones (FFh), where the quantity in the brackets is the hexadecimal number programmed at that address, or all zeroes (00h). For those having to rig up a simple EPROM programming circuit, this makes life easier as all locations are the same logic level, reducing chances of error.

If you have ever manually programmed an EPROM, you will appreciate this fact. A single mistake in programming usually means erasure of

all data and the need to start all over. In accordance with Murphy's Law, this generally seems to happen when you are three-quarters done or more, or have manually entered a few hundred data bytes. We strongly suggest using an EPROM programmer that operates with a PC, if at all possible, if you are going to program a long message.

However, for a short ID such as your call letters, you can get by with a manual programmer. The only location where there is any difference is the last one, used to signify end of message. In this location, an F0h is programmed. This condition is sensed by the logic and used to reset the counter that addresses the EPROM. A diagram showing the programming scheme is shown in **Table 1.**

Circuit operation

Referring to **Fig. 1**, IC1 is configured as a free-running oscillator with a frequency range of 4.5 to 13 Hz. The period of this waveform, which is determined by the total resistance of R2 plus the resistance of speed control pot R1, and capacitor C1, determines the CW speed. Assuming that an average Morse letter plus the space between letters has ten dot periods, this means 27 to 81 letters per minute, or roughly five to 16 words per minute, assuming an average of five letters per word.

This can be changed by changing the value of C1. R3 determines the discharge time of C1 and hence the width of the negative pulses appearing at pin 3 of IC1. This is not critical. R4 is used as a pull-up resistor for the output of the timer IC connected to IC5. A section of IC5, a quad NAND, is used as an inverter to derive the positive-going CMOS-level pulses to drive counter IC2.

Counter IC2 has 12 output lines and thus has 4096 states, and can address 4096 addresses (0000h to 0FFFh) of the EPROM IC3. Note that the counter drives address lines A0 through A11 of IC3.

The A12 line (pin 2 of IC3) is connected to ground. By the way, a switch or a jumper could be arranged to tie pin 2 of IC3 alternatively high. This will result in the addressing of locations 4096 to 8191 (1000h to 1FFFh) of IC3 and a second message could indeed be programmed in this memory space. We did not bother with this as it was not needed, but it should be mentioned in passing.

R15 and C3 provide power and bypassing to the V_{dd}, pin 16 of IC2. R15 actually is probably unnecessary and was used as a jumper to avoid the necessity of a double-sided PC board layout. C4 and C5 provide bypassing for the five-volt DC supply line. The data programmed into the EPROM appears at the 8 outputs O0 through O7 of the EPROM, but we only need O4 and O0. The other output pins can be disregarded.

During the message, the outputs of O4 and O0 are identical. Typically, only the first 50 to 150 addresses will be used, depending on message length, but all 4096 can be used if needed. At the average speed of one Morse letter per second, this allows up to around a six- to seven-minute, 350–420-letter (80-word) message to be programmed.

Output from the EPROM is fed to Q1 via resistors R5 and R6. When the desired output is a space (key up), the EPROM is programmed with an FFh (all ones) and O4 and O0 are high. This biases on Q1 and the collector of Q1 is driven low, causing bias current from collector load R7 to flow to ground. This removes bias fed via R8 and R9 to Q2, cutting Q2 off, and the

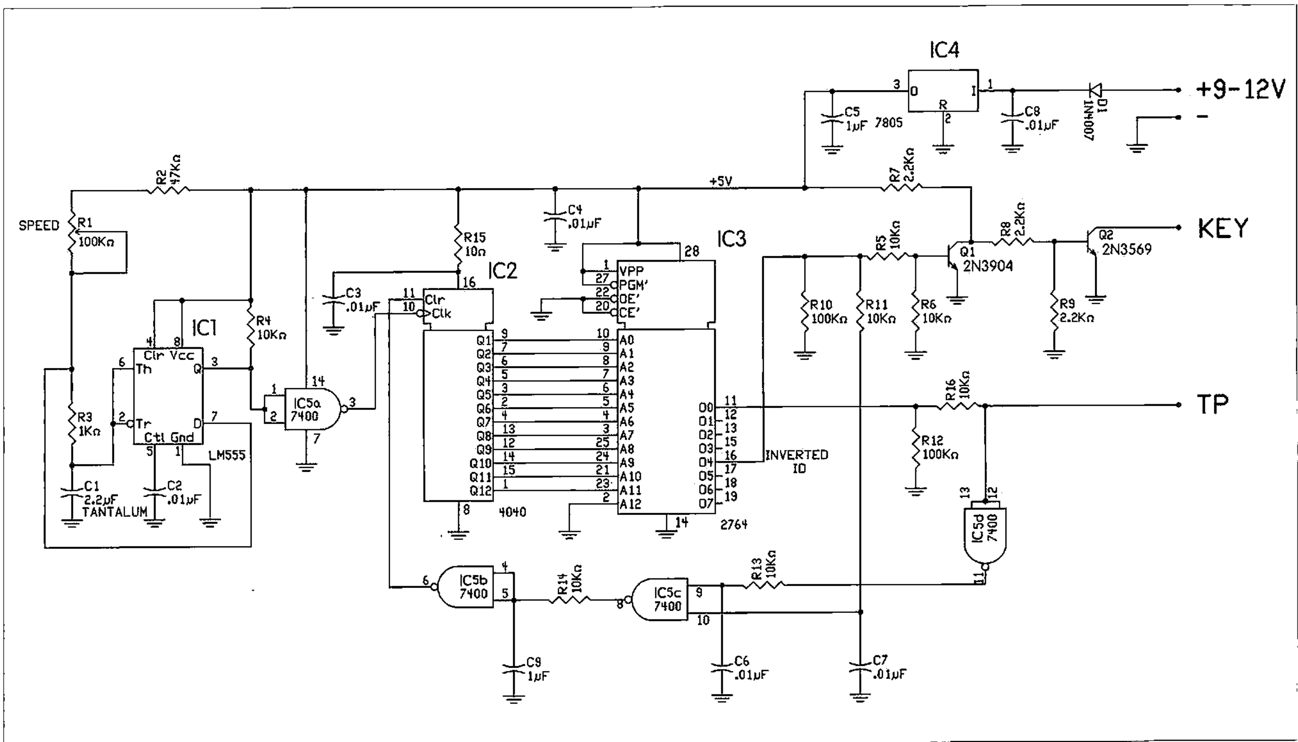


Fig. 1. Schematic. EPROM: FF = space. 00 = mark. F0 = reset counter. TP = test point. Unit shown with TTL-type ICs.

to discharge through R14, eventually driving the input of IC5b low.

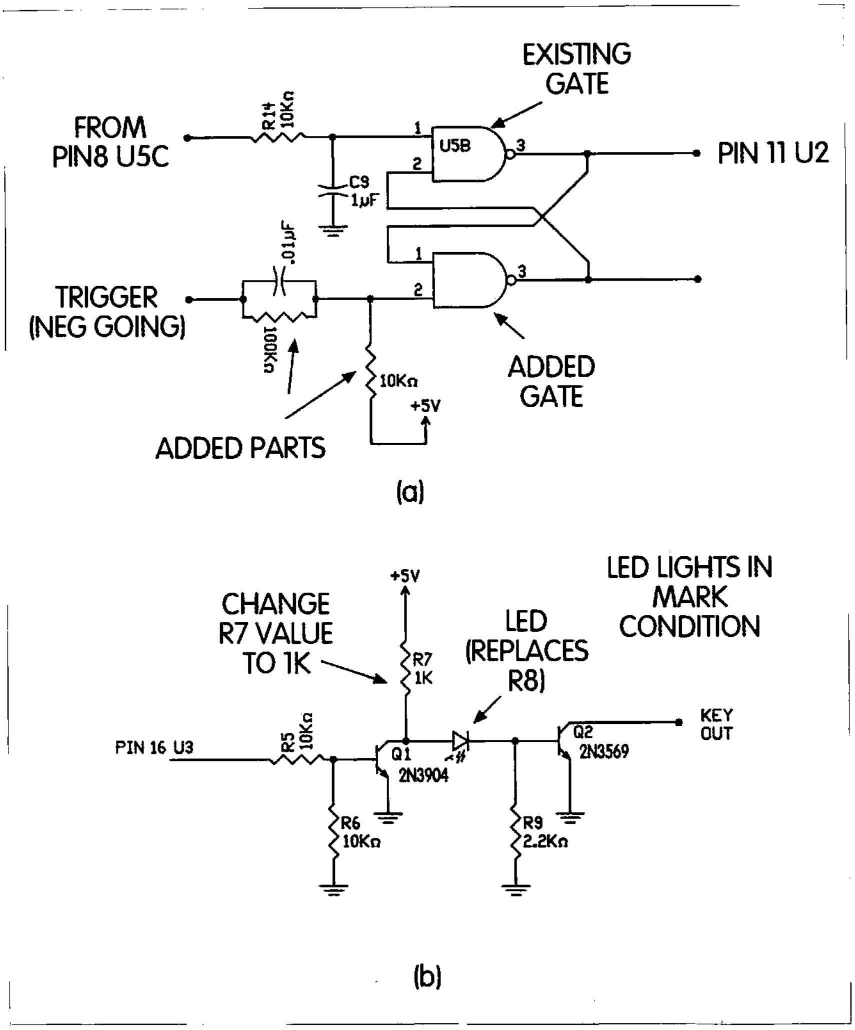


Fig. 2. Modifications. (a) One-shot. (b) Use of LED indicator.

collector of Q2, the keying transistor, is left floating. This corresponds to a key up condition. If a mark (key down) is desired, then a 00h programmed into the EPROM causes Q1 to cut off, allowing bias to flow to the base of Q2 from R8 and R9, turning on Q2. The collector of Q2 is forced to ground, producing a mark (key down) condition.

Normally, O4 and O0 are identical. A sample of O0 is fed via R16 to a section d of IC5. IC5d is configured as an inverter. Its output is fed through RC filter R13, C6 (to remove switching spikes) to one input of NAND gate IC5c. A sample of O4 is fed through similar filter R11, C7 to the other input of NAND gate IC5c. Therefore, the output of IC5c is always high during the message, as the two inputs must be both high for the output to go low.

This high level is passed through RC network R14 and C9, which provides further de-spiking of the output of IC5d. The level out of the RC network is passed to IC5 section b, which is connected as an inverter. The output of the inverter is connected to the reset input of the counter IC2. IC2 will count with a low on pin 11 and reset to zero with a high. Since the output of the inverter will be low during the message interval, the counter will count up starting from zero, sequentially addressing the locations in the EPROM.

After the end of the message, the next EPROM address is programmed with F0h, so that O4 will be high but O0 will be low. This results in both inputs to IC5c being high, which forces its output (pin 8) low. This causes C9 to discharge through R14, eventually driving the input of IC5b low.

Then, the output of IC5b goes high, producing a high level at the pin 11 (clear) input of counter IC1, resetting it to zero. This starts the message cycle over. In addition, C9 holds the voltage at pins 4 and 5 of IC5b momentarily at ground on power-up, providing a reset to counter IC2 and initializing it to zero. This ensures that the message starts at the beginning on power-up. Also, if the counter were not initialized to zero, it might initialize at a count beyond the end of the message. It would have to then count up to 4095 and roll over before the message started again. This could take several minutes and would be very undesirable.

IC4, an LM7805, provides regulated +5 V to the circuit and will work with any input voltage of +8 up to +35 V. It is not necessary to use such a large regulator, but plenty were on hand. A smaller 78L05 will do fine if the supply voltage is kept below about 18 V. D1 provides polarity protection and "Murphy's Law insurance." C5 and C8 ensure regulator stability. Current drain is about 7 mA to 9 mA.

If monostable operation is desired (one ID cycle only rather than continuous operation), a latch could be used between IC5c and the counter. The latch could be reset by the output of pin 8, IC5c, and would hold counter IC2 in a set-to-zero state until this latch was set by an external signal, starting the cycle again. IC5b could be one half of this latch with another gate to form the other, or a discrete transistor could be used to save a gate. The signal would be derived from some outside source and would go low or high as necessary when an ID cycle was required.

We did not incorporate this feature into the circuit, as it would mean another IC package, and we did not need this feature. It is being mentioned for the benefit of those who might need monostable or one-shot operation, as it is easily incorporated into the circuit.

Also, an LED indicator driven by the output of the keying circuit can be added for a visual check of operation if desired. You can substitute an LED for

R8 if you like. R7 could be changed to 1 kΩ to increase LED brightness. Nothing is very critical here. Speed is not important, and we just need to ensure adequate drive to the keying transistor Q2 so as to handle about 50 mA load current. Make sure to observe LED polarity. See **Fig. 2** for these modifications.

Other applications of this circuit are possible. The use of this circuit as a timer with up to 4096 possible on/off segments is certainly feasible. The timing components in the 7555 circuit (R1, R2, R3, and C1) can be made large enough (resistors of around 20 megs and tantalum caps of 10 µF or

Continued on page 20

Parts List

R1	100 k pot
R2	47 k
R3	1 k
R4, R5, R6, R11, R13, R14, R16	10 k
R7, R8, R9	2.2 k
R10, R12	100 k
R15	10
C1	2.2 µF 35 V tantalum
C2, C3, C4, C6, C7, C8	.01 disc GMV
C5, C9	1 µF 35 V electrolytic
D1	1N4007
Q1	2N3904
Q2	2N3569
IC1	ICM7555 CMOS timer
IC2	CD4040 counter
IC3	27C64 CMOS EPROM
IC4	LM7805 5 V regulator
IC5	74C00N quad NAND

Misc.: PC board; 4-40 BHMS; 4-40 lockwasher; 4-40 hex nut

Table 2. All resistors are 1/4 W 5%; IC sockets. CMOS or TTL versions of the chips may be used if desired.

Build This Simple CW Identifier
continued from page 19

more) to produce clock speeds of as low as one cycle per several minutes. Do not use aluminum electrolytic capacitors, as their leakage will be too high for this application and circuit operation will be erratic and unreliable.

Large values permit a 4096 state cycle that may easily exceed one week. Almost any conceivable timing pattern within this time interval can be programmed, with 4096 segments possible. If no reset is used, the counter will simply roll over to zero when a count of 4096 is reached, and then repeat the cycle. An optoisolator and triac arrangement could be used to control large AC loads at 120 V or 240 V line voltages. Similarly, the counter can be speeded up and used to generate serial digital waveforms for experiments or as an arbitrary waveform source.

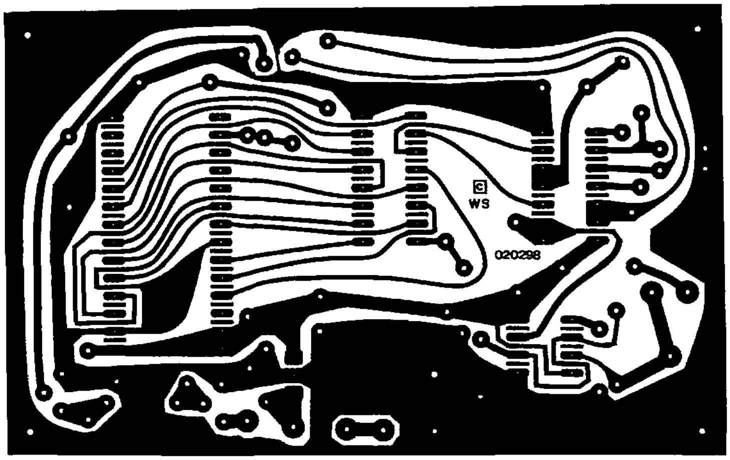


Fig. 3. Foil side of PC board (actual size).

Construction can be from the PC layout in **Figs. 3** and **4.** You could also use Vectorboard® and hardwire the connections, or use "ugly bug" or wire-wrap techniques. The highest frequencies present are in the low audio range, so almost any reasonable layout can be used.

A drilled and etched circuit board for constructing the CW identifier is available for $20 (US), including shipping and handling, from:

North Country Radio
P.O. Box 53
Wykagyl Station
New Rochelle NY 10804-0053

E-mail: [NCRadio200@aol.com]; Web site: [http://www.northcountryradio.com]. Please note that New York residents must add $1.50 sales tax.

A catalog of kits for amateur radio projects, ATV transmitters, downconverters, receiver and video accessory kits, and video and surveillance cameras and lenses is posted at our Web site. In addition, technical articles and construction details on several projects will also be found there. A printed catalog (included free with PCB order) is available for $2 plus SASE with 78¢ return postage from the above address.

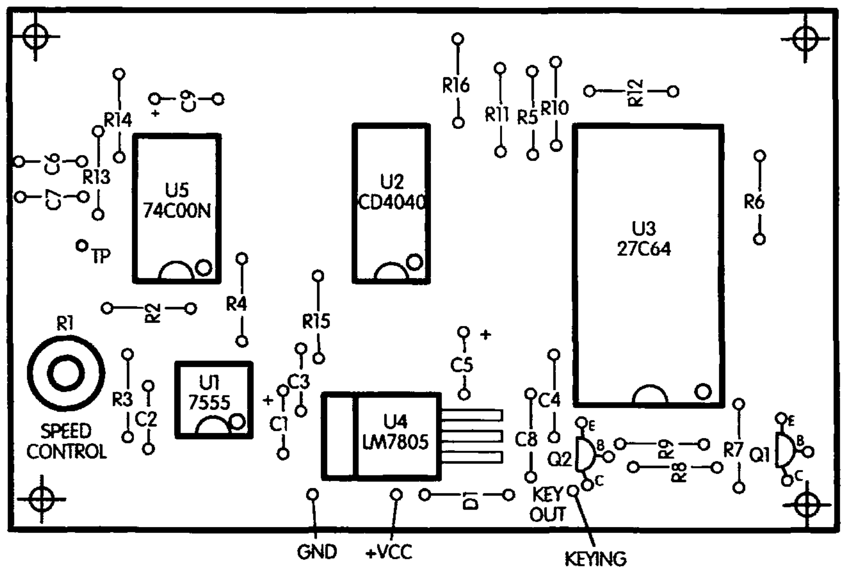


Fig. 4. Parts layout.

FM Revisited

Secrets of stuff you thought *you knew.*

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

Over the years, there have been many schemes developed for modulating a transmitter. The purpose of each was to provide a method for communicating intelligence via radio from one location to another. Of the many schemes or techniques used, amplitude modulation (AM) and frequency modulation (FM) have formed the basis for the majority of techniques.

With both techniques, the intelligence being communicated is carried in sideband energy produced by the transmitter during the modulation process. Although amplitude modulation is still used in AM broadcasting, TV video, and aircraft communications, its form has been modified to single sideband (SSB) for the remaining AM applications.

Frequency modulation (FM) appears to be the most predominant technique used by both hams and commercial interests for communicating on frequencies above 100 MHz. Because the communication of intelligence is carried in sideband energy produced by a transmitter, let's review AM sidebands to set a foundation before proceeding with FM.

Amplitude modulation

In AM, the audio signal is added to (mixed with) the carrier forming a pair (or set) of identical sidebands which straddle the carrier. These sidebands represent the audio component referred to as modulation and all of the intelligence is carried in these sidebands. A fully modulated signal (100% modulation) has an amount of total sideband power equal to the unmodulated carrier power; when fully modulated, the amount of power in the transmitted signal will be doubled.

The carrier itself contains no modulation, but goes along for the ride when transmitted to assist in demodulating the sidebands at the receiver. Because a pair of identical sidebands are produced containing the same intelligence, either sideband may be eliminated without loss of intelligence. As most hams realize, SSB (single sideband) is a process where the carrier and one sideband are suppressed at the transmitter, permitting only one sideband to be transmitted. However, upon receiving the SSB signal, a carrier must be reinserted at the receiver as a replacement for the one removed prior to transmission.

As a final observation regarding AM, the transmitted power in AM sidebands varies as a function of the audio amplitude, and the frequencies of the sidebands are a function of the audio frequencies as they are mixed with the carrier. It is important to note that the carrier frequency remains stationary, but the sidebands come and go in accordance with the audio.

Frequency modulation

Like AM, FM also generates sidebands during the modulation process. But unlike AM, the carrier changes frequency and the composite signal (carrier and sidebands) remain at a constant amplitude. An FM transmitted signal can be obtained by either of two basic modulation methods. One is direct, sometimes referred to as true FM, and the other is an indirect method called phase modulation (PM). In the direct method, the audio signal is introduced directly into the carrier oscillator, causing it to shift frequency in direct correspondence to the audio amplitude. With PM (phase modulation), the audio signal is introduced into a phase modulator stage which follows the oscillator. The oscillator

frequency remains constant at all times with PM, but the combining of the oscillator signal and audio create a new signal which is phase-shifted from the oscillator. The phase angle of this new signal varies as a function of the audio voltage amplitude.

In an FM transmitter, the amount of frequency or phase shift that occurs is small at the point of modulation. To obtain the amount of desired shift (deviation) at the transmitted carrier frequency, it is necessary to multiply the shift through the various frequency multiplier stages of the transmitter. As an example, if the oscillator is operating at approximately 6 MHz and the transmitted output is 146 MHz, the amount of multiplication is 24. It follows, then, that if the transmitted frequency shift (deviation) is 5 kHz, the amount of shift at the oscillator/phase modulator will be 1/24th of 5 kHz, or 208.33 Hz.

There is a significant difference between direct FM and phase-modulated FM that needs to be discussed. In the generation of a phase-modulated signal, the phase modulator causes the signal phase angle shift, as a function of the audio frequency, to be pre-emphasized at 6 dB/octave. As the audio frequency increases, say from 1 kHz to 2 kHz (one octave), the carrier is shifted by a factor of 6 dB. Direct FM, on the other hand, has essentially a flat response to a change in audio frequency. This response difference matters when the transmitted signal is received. To demonstrate the difference, it would be necessary to set up two transmitters operating without pre-emphasis compensation, one using direct modulation and the other using PM. A noticeable audio response difference would be observed when receiving the two signals alternately by a receiver. With the 6 dB pre-emphasis, the PM signal would sound more "brilliant," with its higher audio frequencies emphasized, as compared to the "flat" response of the direct method.

To go one step further, if the receiver was de-emphasized at 6 dB/octave to accommodate PM, the direct method would sound bassy because the higher frequencies have been rolled off. However, both direct and PM modulation methods may be used by different transmitters in the same communications service. To create the same recovered audio response at the receiver, it is necessary only to adjust the pre-emphasis network in the transmitter to produce the desired response at the receiver.

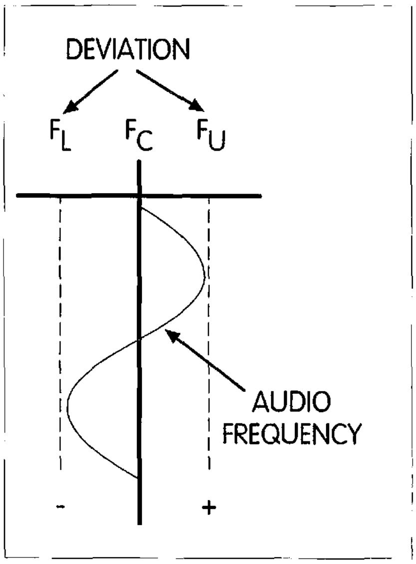


Fig. 1. Relationship of deviation to the audio voltage.

Terms

To gain a better perspective of FM, it is necessary to define several terms that describe the modulation process and resulting sidebands. The terms relating to FM probably describe FM better than any word description or example that can be cited. In short, understanding the terms provides a concise capsule of FM.

Deviation

Deviation is the amount of instantaneous carrier shift from its resting point (center frequency of the carrier without modulation). The shift may be measured in either the plus or minus direction from the carrier. Deviation is a direct function of the audio signal amplitude. In other words, the audio amplitude controls the amount of deviation as shown in **Fig. 1**. Observe the carrier shift from F_C toward F_U as the audio sinewave increases in a positive direction. A matching shift from F_C to F_L will occur as the sinewave increases in a negative direction. This example assumes that the modulator, whether direct or PM, will produce an equal shift in both directions (symmetrical shift).

Rate of deviation

The rate of deviation is the speed with which the carrier moves while deviating and is a function of the audio frequency. Simply, the frequency of the audio controls the rate of deviation. This relationship can be imagined in **Fig. 1** by observing the increasing sweep rate from F_U to F_L and back as the audio frequency is increased.

Modulation index (M)

Modulation index is a term which describes the complex sideband structure created by the FM process, and is related to the combining of frequency deviation and the audio frequency. Values of modulation index provide, in capsule form, a total description of FM sidebands. In essence, modulation index describes the transmitted signal bandwidth as a function of significant sidebands produced during modulation. A sideband is considered significant when it has a power value equal to, or greater than, 1% of the unmodulated carrier. For a graphical view of FM, a Bessel Function chart shows the complex sideband structure produced by FM and the following equation shows the ratio of the factors involved.

$$M = \frac{\text{Max deviation allowed}}{\text{Highest actual audio freq}}$$

Table 1 shows a partial listing of sideband quantities as a function of M values. Values indicated in the table were obtained from a Bessel Function chart by counting the number of sidebands having a power amplitude greater than 1% of the resting carrier power.

Deviation ratio (DR)

Deviation ratio is a specialized form of modulation index where the two factors are the maximum values allowed. As a comparison, the modulation index utilizes the maximum deviation allowed with an actual audio

Modulation Index (M)	Number of Sidebands
1.0	3
1.5	4
1.67	4
2.0	4
3.0	6
4.0	7
5.0	8
6.0	9

Table 1. *A sampling of the number of significant sidebands as a function of modulation index (M).*

frequency. The following equation shows how DR can be determined.

$$DR = \frac{\text{Max deviation allowed}}{\text{Max audio freq allowed}}$$

Bandwidth (BW)

The term bandwidth describes the amount of frequency spectrum occupied by the transmitted signal. Bandwidth is a function of the number and spacing of sidebands, and is controlled by the highest modulating audio frequency. The following equation shows how the bandwidth can be determined when the number of significant sidebands and highest audio frequency are known. The number of sidebands as a function of M values may be obtained from **Table 1** or by examining a Bessel Function chart. It is necessary to double the number of sidebands, as the data obtained from the chart and table represent only the number of sidebands on one side of center frequency.

$$BW = 2(\#\ SB) \times (\text{audio freq})$$

Bessel Function chart

Perhaps the best way of describing sidebands as generated by an FM transmitter is to examine a Bessel Function chart adapted to values of M (modulation index) as shown in **Fig. 2**. Although Bessel Functions may be carried out to infinity, it is rarely necessary to

Continued on page 24

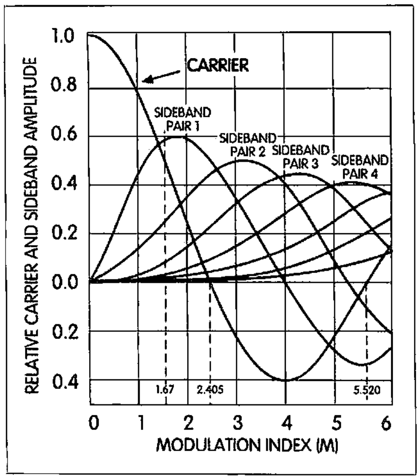


Fig. 2. Bessel Function chart used to show signal amplitude versus modulation index.

FM Revisited

continued from page 23

chart the functions beyond a modulation index of five. For ham use, a modulation index of 1.67 is sufficient, where the chart is concerned with determining the number of sidebands produced as a function of deviation. Another important feature of the chart is the indication of when the FM carrier passes through a null point. This indication is needed for an accurate measurement of deviation and is used for calibration purposes.

The chart provides insight through graphical presentation of the complex carrier and sideband structure created by the FM process. But the chart shows only one-half of the total sideband structure. The other half is a direct mirror image of that shown. Therefore, examining one side is sufficient for obtaining all of the information needed for understanding the structure.

Examining the chart reveals its structure and layout. The bottom horizontal line is marked off in units of M from zero to six. The vertical axis indicates signal amplitude from zero to 1.0 (100% of carrier power) in the positive direction. For most ham applications, only the amplitude, not polarity, is of interest. Observe, also, that the majority of significant sidebands are predominantly positive for values of M below five.

At M = 0, observe that the carrier amplitude is at 1.0 (100%), indicating there is no audio signal present. At this point, all sidebands are equal to zero. Following only the carrier curve, observe that it begins to decrease in amplitude as the modulation index increases. This is an indication that the audio signal amplitude is increasing.

Note that the carrier amplitude passes through zero when M = 2.405. At this null point all of the modulation intelligence is contained in the sidebands. With continued increases in deviation, the carrier will pass through additional null points at modulation index values of 5.52, 8.654, 11.792, 14.931, 18.071, etc. Each numerical point is separated by approximately the value of pi (3.14).

Determining the number of sidebands from the chart is simply a matter of counting the number of sideband lines crossing the vertical M value line. At M = 5, there are eight sideband lines and at M = 1.5 (also 1.67), there are four. The carrier is not counted, as it is not a sideband.

Once the number of sidebands at a given M value has been determined, then the frequency occupancy of the transmitted signal can be calculated. As an example, to find the bandwidth of a VHF ham-transmitted signal having 5 kHz deviation at an audio frequency of 3 kHz, it is necessary to determine the value of M and the number of significant sidebands. An M value of 1.67 is found by dividing 5 kHz deviation by 3 kHz audio. For 1.67, the Bessel Function chart reveals that four significant sidebands exist per side for a total of eight sidebands. Therefore, the bandwidth occupancy of the ham transmitted signal is 24 kHz (8 SB x 3 kHz).

Summary

FM has become a very popular means for communicating intelligence from one place to another. With the multitude of transmitters operating on the bands, bandwidth occupancy becomes an important factor, and can be controlled by the amount of deviation and the highest transmitted audio frequency. Studying the terms and tools associated with FM will provide the insight needed to understand the technical characteristics of FM. Terms such as deviation, bandwidth, and modulation index describe the very heart of FM, with tables, equations, and a Bessel Function chart serving as tools for examining the characteristics in detail.

For more in-depth study of FM, here's a list of suggested reading:

The ARRL 1985 Handbook. Newington, Connecticut. Pg. 18-21.

Elements of Electronic Communications, Joseph J. Carr. Reston: Reston Publishing Co., Inc. 1978. Pg. 363.

Frequency Modulation Receivers, A.B. Cook and A.A. Liff. Englewood Cliffs: Prentice-Hall, Inc. 1968. Pg. 27.

Reference Data For Engineers: Radio, Electronics, Computer, and Communications, Edward C. Jordan (ed.). 7th edition. Indianapolis: Howard W. Sams & Co., Inc. Pgs. 24-8, 46-38, 47-9.

Radio Handbook, William I. Orr. 21st edition. Indianapolis: Editors and Engineers. Chapter 13.

Handbook of Electronic Instruments and Measurement Techniques, Harry E. Thomas and Carole A. Clarke. Englewood Cliffs: Prentice-Hall, Inc. 1967. Pg. 275.

Electronic Communications Systems, Wayne Tomasi. Englewood Cliffs: Prentice-Hall, Inc. 1988. Chapter 7.

Vintage Values

Heading for a hamfest? Tempted by the timeless?

Bill Clarke W2BLC
764 Alta-Voor Road
Altamont NY 12009

Thinking about buying an older rig? One of those operable vintage rigs? Want to put an old-timer on the air? Perhaps an old Collins KWM-2 or a Drake TR-4C is of interest to you ... or a Hallicrafters, National, or other make or model of vintage ham equipment.

Vintage ham equipment, mostly built during the '50s, '60s, and '70s, consists of tube-based rigs that glow in the dark and can effectively warm your shack on a cold winter's night. Of course, *some* will say vintage rigs are merely cranky rigs that require manual retuning every time you QSY, that they constantly drift up and down the band, and that they always need tinkering to keep them on the air. In general, vintage equipment is fondly (sometimes less so) referred to as "boat anchors."

There is a following for vintage AM equipment, such as Johnson and many Hallicrafters rigs. AM is alive and well on 75 meters in the evenings, and in New England there is a nice group heard in the middle of every morning. Vintage CW equipment is less costly to purchase and maintain than either SSB or AM rigs. There are some very fine vintage CW stations on the air. However, the big interest appears to be for vintage SSB equipment.

For the most part, the classic rigs were made famous when the great names of Fort Orange Radio, Evans Radio, Walter Ashe Radio, Uncle George's Radio Ham Shack, and a few others ruled the ham marketplace.

There has been a real resurgence of interest in vintage rigs over the past few years. I have followed with great interest the prices some of these vintage rigs sell for—or perhaps I should say the value some owners place on their boat anchors.

Retail when new

Table 1 is a list of popular US-built vintage SSB ham equipment listed by make, model, type, year of production, and retail price (at that time). Not every piece of equipment available is listed; however, the more common and well known are shown. A very few are in a category all by themselves, that of the vintage solid state rig. Even a few linear amplifiers fit into the vintage era.

Vintage values

It's interesting to note that particular pieces of vintage equipment bring high prices—high, that is, in comparison to similar equipment of other manufacturers, built at about the same time. Of course, the justification is usually based upon the quality of original manufacture, a factor that may be based more in the mists of time and lust than on fact.

Support for equipment maintenance must be taken into consideration when talking values. For example, Collins appears to have good parts support and lots of advice for keeping the equipment operating—due, no doubt, to the large numbers of the various Collins rigs still in existence. There seem to be no terrible parts shortages—if you're willing to pay the price. This will, in time, change, as the junk rigs get stripped of parts. Support and advice is available from the Collins Collectors Association, P.O. Box 840924, Pembroke Pines FL 33084.

Drake still offers factory support for their equipment. The work isn't cheap; however, it is very good. Send a rig to Drake for service and it will return looking great and working like new. Contact R.L. Drake at (513) 746-6990; by FAX (513) 743-4576; or by E-mail at [bill_frost@rldrake.com] for additional

Make	Model	Type	19__	$	Make	Model	Type	19__	$	Make	Model	Type	19__	$
Atlas	180	1	73	479	Galaxy	V Mark 2	1	67	420	Heath	HW-100	1	69	250
	210	1	75	599		V Mark 3	1	68	420		SB-220	7	69	350
Collns	32S-1	2	58	590		AC-400	4	68	90	Henry	2K-3	7	64	745
	75S-1	3	58	495		2000B	7	68	495		2KD-3	7	64	745
	516F-2	4	58	105		GT-550	1	69	475		2K-Uitra	7	70	845
	312B-3	5	58	28		SC-550	6	69	25		2K-4	7	70	795
	312B-4	6	58	185	Hcrftrs	SR-150	1	62	350		2KD-4	7	70	795
	30S-1	7	58	1560		SX-117	3	62	380		Tmpo 1	1	71	298
	30L-1	7	58	520		PS-150	4	62	100		AC/One	4	71	99
	KWM-2	1	60	1150		SX-122	3	63	295	Johnsn	Valiant	2	56	440
	312B-5	8	60	350		HT-44	2	63	380		Rnger II	2	61	360
	32S-3	2	62	750		HT-45	7	63	500	Nationl	NCX3	1	63	369
	75S-3	3	62	680		SR-160	1	63	395		NCXA	4,5	63	120
Dentrn	MLA2500	7	77	800		SX-146	3	65	250		HRO500	3	65	1295
	Clip'on-L	7	78	600		HT-46	2	65	295		NCX5	1	67	549
	GLA1000	7	78	379		SR-400	1	65	800		NCX500	1	69	425
Drake	TR-3	1	63	550		PS-500A	4	65	120		AC-500	4	69	99
	AC-3	4	63	80		SR-2000	1	65	1095	SBand Engnrs	SBE-33	1	63	390
	RV-3	8.5	63	80		PS-2000	4	65	450		SBE-34	1	65	395
	R-4	3	65	380		HA-20	9	65	200		SBE-36	1	72	895
	T-4X	2	65	400		FPM-300	1	72	595	Signl 1	CX7A	1	71	2195
	AC-4	4	65	100		FPM-300/II	1	74	625	Swan	SW-120	1	61	275
	MS-4	5	65	20	H-lund	HQ-110	3	57	239		SW-240	1	63	320
	L-4	7	67	825		HQ-180	3	60	429		SW-117	4	63	95
	R-4B	3	68	430		S-200	5	60	20		350	1	64	395
	T-4XB	2	68	449		HX-500	2	60	695		117XC	4,5	65	95
	L-4B	7	68	825		HQ-145X	3	61	269		Mark II	7	67	630
	TR-4C	1	72	600		HX-50	2	61	400		500-C	1	68	520
	R-4C	3	73	500	Heath	HX-20	2	62	200		270-B Cygnet	1	70	499
	T-4XC	2	73	530		HR-20	3	62	135		500-CX	1	70	565
ETO	Alpha 77	7	72	1795		SB-200	7	64	220		700-CX	1	73	570
	Alpha 78	7	78	2400		HW-12A	1	66	100		350-A	1	77	600
Galaxy	300	1	63	300		HP-23A	4	67	54	WRL	Duo-Bander	1	65	160
	G300D	4	63	120		SB-101	1	67	360		AC384A	4	65	90
	III	1	64	350		SB-600	5	67	18		Duo-Bndr II	1	69	170

Table 1. *US-built vintage SSB ham equipment. Type codes: 1—xcvr. 2—xmtr. 3—rcvr. 4—AC PS. 5—spkr. 6—spkr/console. 7—linear amp. 8—VFO. 9—VFO/SWR meter.*

information. Drake, however, cautions that some parts are getting very scarce.

It may be less difficult to "make a rig operate properly" than it is to "restore to like-new." The latter can enhance the value of a rig to a collector. National,

Year	Conversion Factor	Year	Conversion Factor
1950	0.163	1974	0.322
1951	0.176	1975	0.349
1952	0.179	1976	0.368
1953	0.180	1977	0.392
1954	0.181	1978	0.419
1955	0.181	1979	0.459
1956	0.184	1980	0.511
1957	0.189	1981	0.559
1958	0.195	1982	0.593
1959	0.196	1983	0.618
1960	0.200	1984	0.645
1961	0.202	1985	0.667
1962	0.203	1986	0.680
1963	0.207	1987	0.705
1964	0.209	1988	0.734
1965	0.212	1989	0.769
1966	0.218	1990	0.811
1967	0.225	1991	0.845
1968	0.234	1992	0.870
1969	0.244	1993	0.896
1970	0.256	1994	0.919
1971	0.267	1995	0.945
1972	0.275	1996	0.973
1973	0.293	1997	1.000

Table 2. Consumer Price Index (CPI) conversion factor chart 1950 through 1997. To convert from a prior year, divide dollar amount by conversion factor; e.g., 1950 price of $425 is divided by conversion factor of 0.163 to get 1997 dollar value of $2607. To convert from the present, multiply dollar amount by conversion factor; e.g., present price of $1995 is multiplied by conversion factor of 0.225 to get 1967 dollar value of $449.

Hallicrafters, Galaxy, and the others all suffer from a lack of parts and no strong support organization. Heathkit suffers all the more, as there is no real measure of assembly quality. The rigs were all kits at one time or another and assembled by a widely spread group—some with good construction and soldering skills and others without.

Value examples

What can you expect to pay for a vintage piece of ham equipment? Well, it will depend upon the make, model, and condition of the individual unit. There are no accurate price guides, as the market is too small—with too few examples being bought and sold. In general, Collins equipment will be at the top of the price heap, with Drake next. The others will follow depending upon the specific model.

Old value

The original selling price for new equipment is generally an indicator of

its value today. Collins equipment sold for the most money then, and it still does today. WRL (World Radio Labs) sold for the least and also still does. The last WRL DuoBander I saw was sold for $75 at a hamfest—and it was on the air the night it was bought. Its price *new* was only $160. Hmmm!

In late 1997 I saw a Collins KWM-2, with the matching speaker/console and AC power supply, sell for over $2500. The equipment was described as being in perfect condition. The original cost of this combination was $1140. That's nearly $1400 more than it sold for new, right? Wrong! To look at true values we must compare dollars today with the dollars from years past.

Consumer Price Index

The Consumer Price Index (**Table 2**) is the official means of comparing what the current dollar buys, with the dollars of past years. For example, today's (1997) $1000 has the same purchasing strength as did $163 in 1950. To place this into perspective, a really good job of the same year paid about $5000 annually. See the table for the factors to be used when converting 1997 dollars to other years from 1950 to present.

Now let's look again at that Collins station. It cost $1440 new in 1960 and sold for $2500 in 1997. Using the CPI chart, we find that in 1960 dollars this used rig is worth $500; it retained about 33% of its original value. How did the WRL DuoBander fare? Well, its selling price of $75 was the same as $16 in 1965. It retained about 10% of its value.

A Drake TR-3 with matching speaker, remote VFO/speaker, and power supply, listed in like-new condition, sold for $285. Its cost new in 1963 was $710. In 1963 dollars, the TR-3's used value is $59. It retained *less* than 10 percent of its original value.

There are loads of examples of rigs and prices to compare. Some, such as the Collins S-line and KWM-2 series were in production for many years. Values vary widely over the entire production run. Other rigs, such as the National NCX-3 and Heathkit HW-100 transceivers, will never bring top dollar. They do, however, offer an inexpensive entry into the world of boat anchors. I often see these low-end boat anchors selling for under $100, in near- or fully-operable condition.

Setting a fair price

There is a formula for setting a fair value on a piece of vintage ham equipment, which goes something like this: The selling price is the amount of money the seller of the fine top-quality vintage rig agrees to accept from the purchaser of the same broken-down worn-out radio.

Are vintage rigs a good deal?

The Yaesu 1000MP lists for about $3000 and is considered by many to be a good example of state-of-the-art equipment. The 1000MP includes a power supply, automatic antenna tuner, DSP, extra filters, memories, digital accuracy, etc. If it had been available in 1960, the 1000MP would have cost $600, considerably less than the Collins example shown earlier in this article. You get a lot of radio for the money today, when you compare the capabilities of today's equipment to what you got for the same value back in the vintage days. However, this statement is in no way meant to take away from the pleasure of owning and using vintage equipment.

Where to find vintage equipment

Vintage ham gear can be found at most hamfests, listed in the famous "yellow sheets," heard about on swap nets, and listed in a dozen locations on the Internet. Generally, you will find prices to be the lowest when dealing directly with an owner, locally—where no shipping is involved. Equipment from dealers will be the most expensive. However, the rigs are usually checked out prior to sale and repairs made where necessary. The following commercial/semi-commercial sources can be contacted by mail or telephone, or found on the Internet:

Chris Seig Surplus
P.O. Box 123
Hillsboro NH 03244
(603) 464-5625
[www.conknet.com/piexx/piexx/piexx.htm]

Joel Thurtell
The Radio Finder
975 Arthur
Plymouth MI 48170
(313) 454-4666
[www.radiofinder.com]

Radio Recyclers
7730 W. National Avenue
West Allis WI 53214
(414) 771-7121
[www.execpc.com/~radiorec/]

Note: This list is not meant to be exhaustive in nature. If you know of suitable additions, contact me at: [W2BLC@bigfoot.com] or mail me a letter. Are you interested in these older rigs and want more information? Watch for more articles about individual rigs coming in the future.

Home-Brew RF Ammeter for the Shack

Another fun project from W4LJD.

J. Frank Brumbaugh W4LJD
c/o Defendini
P.O. Box 30
Salinas PR 00751-0030

Now you can simplify tuning up, save the cost of an SWR meter, and still be assured of sending maximum possible RF to your antenna—and know that your SWR is as low as possible. Three facts prove this statement:

• When maximum forward RF current is delivered to your antenna, this is the most your rig will put out.

• When maximum forward power is delivered to your antenna, reflected power and SWR are at the minimum possible.

• The above two facts are reciprocals of each other. As forward power increases, reflected power decreases simultaneously.

A little history

Forty and more years ago, before the SWR meter was invented at Collins Radio, hams used RF ammeters in their feeders to indicate maximum current, and therefore maximum power, to their antennas. These meters were installed between the transmitter output and the feeders in the shack. Many hams used two ammeters, one in each wire of their 600 Ω open wire feeders (there wasn't any coax in those days, either). No separate antenna tuners were used because transmitters used either an adjustable link output or, more recently, a pi network between the final tube(s) and the feeders. This essentially accomplished the purpose for which we use antenna tuners today, because the output stage of our transceivers is broadbanded and not tunable. Rigs were tuned for maximum RF current in the feeders, and we worked the world.

The SWR meter

The SWR meter is a wonderful device in these days of solid state 50 Ω output transceivers. Used between the transceiver and the antenna tuner, it allows monitoring forward and reflected power while adjusting the antenna tuner for a conjugate match and the lowest SWR presented to the transceiver, on either a single switched meter, or two separate meters. A cross-needle meter is two meters combined in the same case.

Many hams build their own SWR meters because commercial units are rather expensive. However, the builder needs to take great care to assure symmetry and short leads—and the layout must be precise, too. At least one meter is required, and meters today can be very expensive.

My solution

A properly-used RF ammeter can easily substitute for an SWR meter, but they are extremely rare and very expensive, even in the surplus market. Additionally, RF ammeters are intended for use in low impedance lines, such as 50 Ω coax. However, an RF ammeter placed between the transceiver and antenna tuner, where the SWR meter is normally installed, does *not* provide accurate information! Tuners can do all kinds of weird things to indications on RF ammeters in this location, none of which bear any resemblance to what is going on in the real world. No, the only correct place for an RF ammeter to indicate accurate power is at the *output* of the antenna

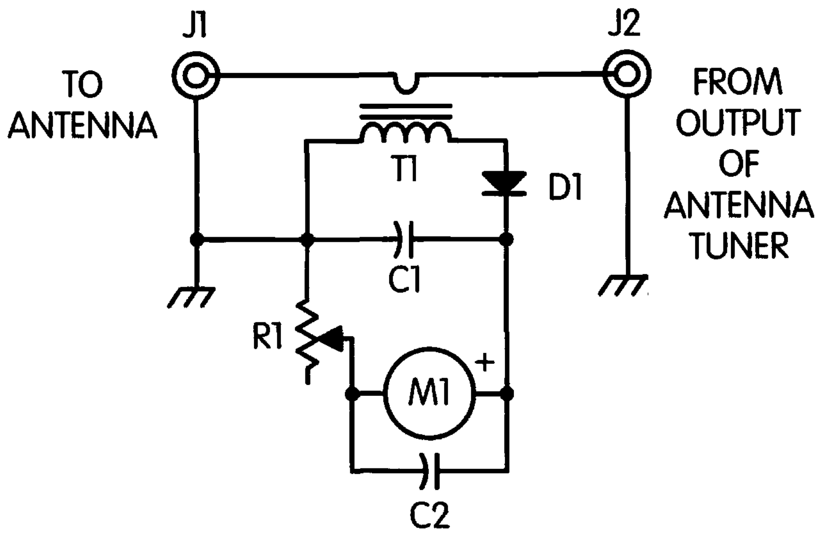


Fig. 1. Schematic for the home-brew RF ammeter.

tuner. Therefore, what is needed is an analog of an RF wattmeter which is not restricted by the impedance in its measurement location.

The accurate home-brew RF ammeter

The circuit of this unit is illustrated in **Fig. 1**. It is far simpler than the most bare-bones SWR meter yet it delivers accurate results, and is much less expensive and easier to construct than an SWR meter.

Toroid transformer T1 consists of 40 turns on a T37-6 toroid, with the primary "winding" a single pass through the core. RF current flowing through the single wire primary of T1 feeds directly through the feeders to the antenna. This current flow induces a voltage in the secondary winding of T1, which is rectified by D1, filtered by C1, and applied across the meter M1 and sensitivity control R1. R1 is required to keep the meter needle on scale at various power levels and on different bands. The higher the current in the feeders and the primary of T1, the greater the voltage across the secondary winding. When peak current is indicated—when no more power can be gotten from the transceiver—when the needle won't go any higher at your current power level, the antenna tuner is properly adjusted and the SWR is at its minimum. (Refer to the three facts quoted in the first paragraph.)

Some comments

There is nothing sacred about the values of the parts given in **Table 1**. This is primarily a junk box project, and the values shown are those I used from my junk box. Different toroids could be used, and the number of turns in the secondary of T1 can differ, depending upon whether you operate QRP, as I do, or have a monster amplifier in your attic. The meter, also, can be anything from 50 µA to a few milliamps, depending upon your RF power level. High-power stations should use either a 1N270 or 1N4148 for D1, and really high-power stations may want to use two diodes in series, as well a larger toroid.

There is nothing special about the circuit, and it is not original with me. In fact, it is about the same as the forward power portion of many SWR meters. All I did was to put it in the proper place so it could do what I intended it to do—replace SWR meters. Because of where it is located, and the reciprocity of forward *vs.* reflected power, it is no longer necessary to measure the latter. SWR will *always* be minimum when the meter indicates the highest forward current peak and is delivering the highest power to the antenna.

Any questions?

Q. Why do I need this when I already have an SWR meter?

A. *You don't. But it's easier to watch one meter than two, or to have to switch one meter back and forth. See also: Final thought.*

Q. Will it work between my 100 W transceiver and my amplifier?

A. *I don't know. But you really want to know the maximum power to your antenna, not the drive to the grids or cathodes of your amplifier. Think about it.*

Q. Can this meter be calibrated to indicate output power?

A. *Yes, over the range of power you normally use, but not if you operate at 100 mW one day and 1500 W the next. Be reasonable. Set R6 with the needle at peak at the maximum power you want to indicate with the needle slightly less than full scale, and mark this power. Reduce power until the needle at peak at the lowest power you want to indicate is a bit above zero.*

Then calibrate the meter at whatever intermediate levels you wish, always tuning for the peak on the meter at each power level.

Q. I usually operate at less than one watt output. Will this unit work at milliwatt levels?

A. *Yes. Depending upon how low in power you go, you may need to increase the number of turns on T1 secondary, or make the primary one or*

Continued on page 49

Parts List

C1, C2	0.01 µF ceramic disc
D1	Germanium diode, 1N34, 1N60, 1N270, etc.
J1, J2	Coax connectors, builder's choice
M1	590 µA surplus 3-1/2" meter
R1	50 kΩ potentiometer
T1	40 turns AWG-28 magnet wire on T37-6 toroid (yellow)

Table 1. All parts are from author's junk box. See text for discussion on choice of parts values.

Number 31 on your Feedback card

A Look At Pasokon's 3.1 SSTV System

Today's slow-scan gets better and easier.

Michael J. Geier K1BUM
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

SSTV (slow-scan television) has become increasingly popular on the HF bands in the past few years, due to a couple of factors: the personal computer, and the advent of affordable hardware and software to turn it to SSTV use. Also, the graphical nature of the Internet has piqued interest in image transmission, and what could be more fun than doing it over the air?

A major pioneer in this field has been John Langner WB2OSZ, inventor of the popular Pasokon computer-based SSTV system, and proprietor of Absolute Value Systems. There are lots of Pasokon stations on the air, and there are sure to be plenty more of them, especially since the release of the latest generation of Pasokon software, with its powerful new features and low-cost interface options.

The Pasokon setup is one of the most complete available. Unlike some others, this one covers virtually all of the SSTV modes, and there are quite a few! To his credit, John has been incorporating new ones as they've come along. In addition, the Pasokon software has enjoyed periodic upgrades, with new capabilities. The newest version, 3.1, is quite a leap forward.

For starters, this new version does away with what was perhaps the only annoying feature of the old one. Previously, you had to press a "full screen" button in order to see an image in full-screen mode. Once you did that, you lost access to the buttons controlling the program until you went back to "normal" mode, in which the image showed up postcard-sized.

In all fairness, this wasn't the Pasokon's fault. The display standard at the time was VGA, which left no room for anything on the screen when

Photo A. One of the built-in test patterns. Screen captures courtesy of John Langner WB2OSZ.

Photo B. Typical SSTV image received.

Photo C. Another typical SSTV image.

a full-sized image was shown. On today's computers, it's now possible to see an entire 640 x 480 image and still have room for buttons and controls, thanks to the availability of 800 x 600 resolution. It's a pleasure not to have to switch back and forth between modes. If you have only a 640 x 480 screen, though, the old way can still be used.

There are numerous additions to 3.1, so let's take a look at a few of the more important ones:

• Higher image resolution. Images are now saved as 640 x 480, rather than 320 x 240. That's four times the image detail! In the old version, even full-screen images were really 320 x 240.

• More color depth. The old 32,768 colors have given way to 16 million. Of course, as with the 800 x 600 screen resolution, what you'll actually get will depend a great deal on your video card.

• Built-in paint program. Yup, you can paint on images without even leaving the Pasokon program! That can be a lot of fun when relaying pictures back and forth; you can add your own comments, your call, or some drawing to what's already there.

• Support for more file types. Images can be saved and loaded in just about all of the common file formats, including JPEG.

• Thumbnail images. When you go to open an image file, you get a nice little postage-stamp-size picture next to the name. Especially given the eight-character name limitation in DOS, that's very handy when you have lots of pictures and aren't sure what each file contains.

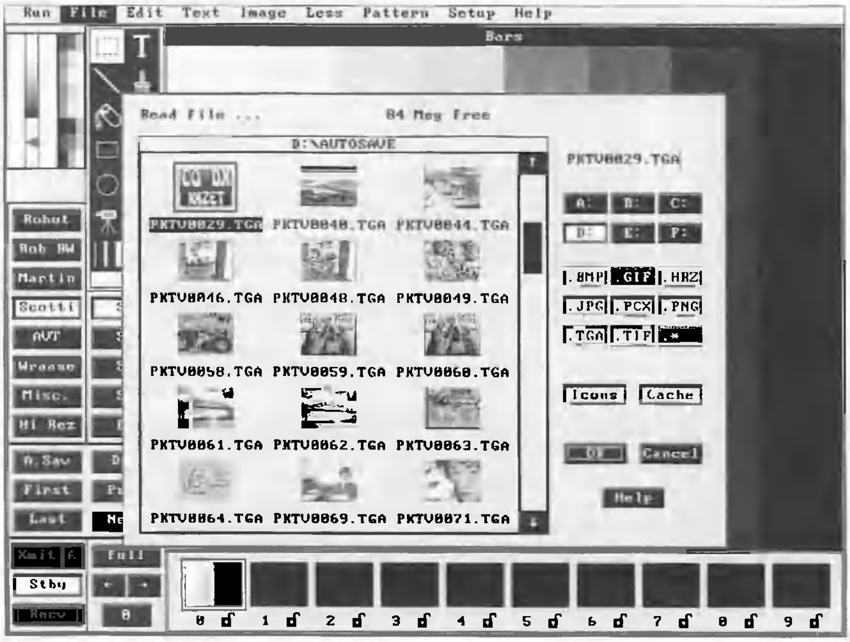


Photo D. Thumbnail images in file selector.

• Contest assist. There's a nifty contest logger here, optimized for SSTV contesting. This one puts the sender's call, your call, and a serial number right on the image! Clever.

• SSTV repeater. This option lets you use your station as a repeater for pictures, so two stations who can't hear each other can still communicate. I haven't actually tried it, but it seems like a good idea, as long as you have a pretty heavy-duty transmitter and power supply (which I don't).

• Automatic image save and load. This one lets you assign certain images to be automatically saved when you quit the program, and automatically loaded back up the next time you restart. It's very handy for pictures you use all the time, such as your CQ shot, shack shot, etc.

• New modes. There are some new ones out there, such as Wraase 120 and 180, Scottie DX, and 480-line, hi-res mode. Version 3.1 covers 'em all.

• Color printer support. With the increasing popularity of color inkjet printers, the ability to print out some of your SSTV images is very appealing. You should have no trouble doing so. In fact, even the gamma (intensity curve) is adjustable, so you can fine-tune things until your printouts match your screen.

• Full 32-bit. The old versions were 16-bit applications. What does that mean? Well, they'd run on 286 machines, but they were less powerful and slower than they would have been if they were full 32-bit apps. The new one uses the full 32 bits of the 386-and-up architecture. The only tradeoff is that it won't run on a 286. Given the antique status of that processor these days, it's not much of a loss.

• On-line help. This program has a very complete on-line help system. Not sure what a button does, or even how to set up your hardware interrupts? The answers are just a click away. I was impressed at the ease with which I found answers to my questions. I've seen plenty of software from big companies which didn't come close in this department.

• Menu options. In the old versions, various setup parameters could be

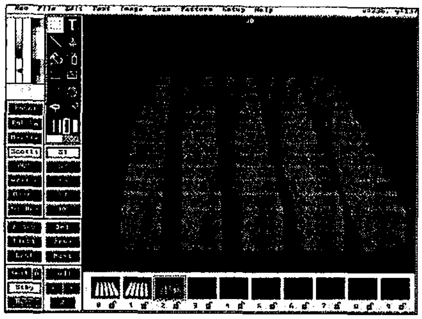


Photo E. 3D picture for viewing with red/blue glasses.

adjusted only by editing the configuration file with a text editor. It was powerful, but it sure wasn't friendly. Especially to beginners, the whole process could be intimidating. Version 3.1 puts most of this stuff into simple menu options that should be easy for everyone.

Three ways to go

There are three variations on the Pasokon theme. The first, Pasokon Classic, uses the standard Pasokon interface board. This board costs $200 and fits in an ISA slot. While the most expensive route, it's also the highest-quality option. The board has an audio filter for digging out the weak ones. It also offers the most accurate demodulation, for the best pictures. Its onboard crystal oscillator offers precise timing, and it has a relay for PTT and transmit audio switching. It's the classy way to go.

Recognizing that there are some very low-cost SSTV systems out there, AVS has wisely chosen to offer its own version. Pasokon Lite costs only $30, and it works with many of the low-cost, serial-port interfaces available from other manufacturers, such as EZ SSTV Vsn 2, GSH-PC, JV Fax, PC SSTV, and others. While AVS doesn't offer its own interface, the new software does come with an on-line schematic for making your own! (See, I told you that the on-line help was complete!) It only takes a few parts, and even the Radio Shack catalog numbers are included. Plus, there are hard copies of two more simple interfaces you can put together.

So, what do you give up by using Lite instead of Classic? The simple interface doesn't offer the image quality of the fancier unit, but it's not bad! You lose the audio filter, of course, and the crystal oscillator. Still, the price is right, and you can use it with computers that don't have an ISA slot, such as laptops. Naturally, it does tie up a serial port. Just think, though ... you're in the woods with a mini-rig, your laptop, and Pasokon TV Lite, and you have a campsite SSTV station! Sounds like fun to me!

EZ SSTV is a stripped-down demo version of Pasokon TV Lite, and it uses the same type of interface. Many of the modes are removed, and file-saving options are limited. Here's the good part, though: it's free, and you can download it off the Internet at [http://www.ultranet.com/~sstv/ezsstv.html]. How can you beat that? Once you know you like it, you can move up to Lite and not have to rewire anything!

Please note: In all versions, there is no digitizer. Getting pictures into your computer is still up to you, as it is with most computer-based systems. These days, though, good digitizers are getting pretty inexpensive, making computer SSTV more and more attractive. And, Pasokon TV 3.1 includes a button for activating a digitizer, so you don't even have to quit the program to snap a picture. Of course, if you have a digital camera, you don't need a digitizer at all! Just transfer the picture files onto your hard drive, and they should load right up, thanks to the Pasokon's support of the common file formats.

Also, SSTV is very sensitive to timing, so it can't be run under Windows. You must have DOS to use the Pasokon TV.

Conclusion

This new edition of the Pasokon TV software is quite an achievement. There's really nothing to complain about. It's very full-featured, it's easy to set up and use, and it works great! SSTVers are quite active on 14.230 and 14.233, just about any time the propagation is running. Check out the action on Saturday afternoons.

Absolute Value Systems offers top-notch SSTV systems at very reasonable prices. If you like SSTV or ever wanted to see what it was all about, you'll find the Pasokon TV a worthwhile purchase, no matter which version you choose. I love my Pasokon TV Classic. Now, if they only had a Mac version ...

For further information, contact Absolute Value Systems, 115 Stedman St. #E, Chelmsford MA 01824-1823; telephone (508) 250-0611.

Take the Jekyll and Hyde Test

Which shack is yours?

Ronald Lumachi W2CQM
73 Bay 26th Street
Brooklyn NY 11214-3905
[W2CQM@juno.com]

A first-time visitor to the home of a radio amateur most assuredly would be overwhelmed by the array of equipment and the layout complexity of the ham shack shown in **Photo A**. When that visitor invariably raises questions about the theory of its operation, the principles of construction, and how all that he sees actually came about, the inevitable response from the amateur is that it had very *humble* beginnings.

During the discussion, the amateur may describe how, in some mystical, helter-skelter, topsy-turvy manner, the shack evolved into his private retreat, filled to overflowing with radio gear. However, the ham is quick to defend his creation, and boasts that he is proud to have a comfortable place of his own and a personalized space for a hook to hang his headphones on. He describes it as a home away from home—a very private enclave.

On the other extreme, his better half laments the choice of this hobby because it keeps him from the timely completion of his chores and at the same time encourages what appears to be just mindless chatter. From the amateur's point of view, though, both he and the station perform a vital function that is generally not fully understood. They participate in emergency communications exercises and generate awards and QSLs that emblazon the walls. This is all the result of his commitment to the hobby and to the quality of the big-gun signal he consistently radiates.

Unfortunately, in most instances the differences of opinion between the spouses usually remain irreconcilable unless the non-ham can be convinced to get a ticket. But of course that results in other problems (two objects cannot occupy the same space ...). Needless to say, that's a story well beyond the scope of this discussion.

Fortunately, the visitor, after some persuasive arm twisting, may reluctantly concede that there is perhaps some logic to the scene and that the space offers some degree of comfort and utility. Yet, even to his untutored eye, and the fact that he's still not 100% convinced, the shack remains the classic example of organized chaos!

In all fairness to the amateur radio community, this is admittedly an example of radio shack design in the extreme. For balance in this presentation, I hasten to mention that there are many radio shacks (see **Photo B**) that, in addition to being state-of-the-art equipped, are thoughtfully planned, artfully constructed, tastefully furnished, and fastidiously maintained. They combine those appealing attributes in a dignified, quiet and reserved manner that showcases every aspect of the hobby.

For example, components are selected for their compactness and power, i.e., small size, big signal. Equipment is purchased in matched sets and grouped on the desktop for eye appeal and ease of operation. There is a conscientious effort to keep the station area clutter-free and functional. This effort incorporates both form and function in a homogeneous composite of strategies to create the ultimate radio room. With all that work, skill, and effort utilized to create this space, the term *radio shack* in this instance just does not seem an appropriate descriptive term for so elegant an entity.

In either of these two extreme examples of the radio amateur's inner sanctum, the experience will have an

equal and lasting impact on any visitor who happens along. The recollections of the visit will be both a vivid and awe-inspiring experience. However, no self-respecting ham will say with any degree of conviction that the neater shack will produce better on-the-air results.

It doesn't necessarily follow that simply because it's more aesthetically pleasing it will do a better job on the air. As a matter of fact, there are stories about super big gun signals that emanate from stations that indeed resemble the classic movie laboratory of Dr. Frankenstein. Whatever the case, it's safe to assume that there will always be examples of Jekyll-and-Hyde radio shacks just as long as there are radio amateurs.

Where does the story begin?

In point of fact, many amateurs often begin their radio careers on a small table in an obscure corner of a room or attic. Others are relegated to the basement area, where more often than not it is dark and drafty. An extension cord, a length of plywood (or old door) fitted across a couple of milk crates, and a battered folding chair combine to form the embryo of the wannabe ham shack.

Within a short time, some basic pieces of test gear, a hand key, a small transceiver, several editions of reference/study material, and a rat's nest of wire begin to crowd the work area. An extension to the table is added to make some room. A fluorescent fixture dangling by a length of chain is installed and an electrical outlet is spliced into an existing line and brought over to the area. In most cases it is tapped off a circuit from some other part of the house. You'll find out soon enough when half the lights and the TV go dead (and the screaming starts) as a result of one of your projects short-circuiting.

But life goes on! The room continues its erratic growth pattern as skill, experience, and equipment accumulate. As junk box inventory expands, space is utilized by piling boxes against the walls and under tables. Equipment on tables and in boxes juts out in all directions and begins to resemble the board game Scrabble® in a well-advanced stage of serious play.

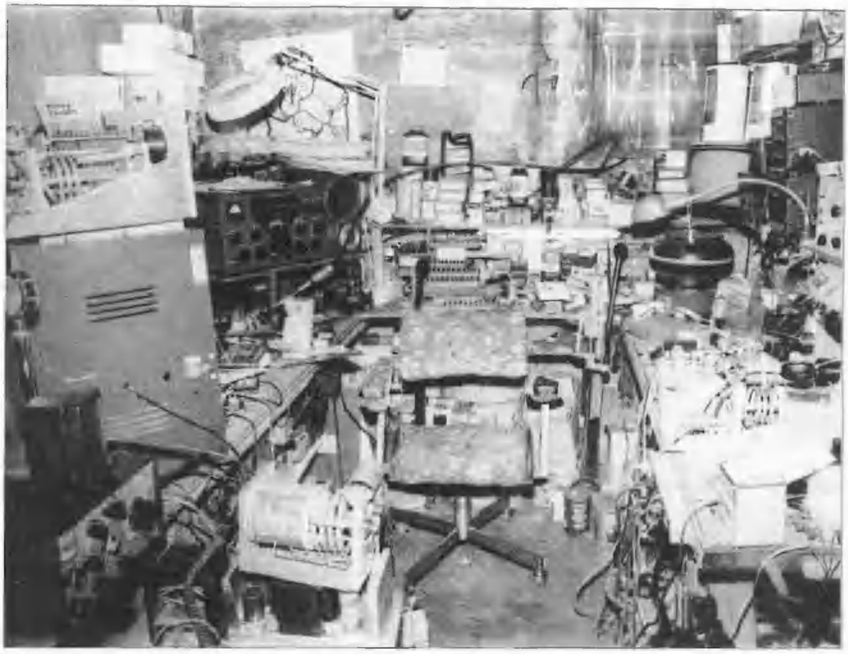


Photo A. An overview of the Mr. Hyde station. Note the jumble of coax cables leaving the shack via drilled holes in the window jamb. Sitting behind the Drake TR-4 (lower left) is a monster circa-1962 power supply for the 813 amplifier (three-tube) resting with no cover on top of the supply. A mint 75A4 and an FT-1000D are nested one above the other in the left-hand corner of the room. On the bench to the right is a 4-1000A deck being reworked for 160 m. The B&W 850A tank circuit can be seen amongst the junk pile. A modified 10–160 m B&W is visible in the foreground awaiting installation in an RF deck equipped with a pair of 8877s. The Drake AC-4 power supply (center front) has the top cover removed and is awaiting the arrival of replacement filter capacitors for the HV doubler circuit.

Only when good sense prevails will a contract go out to an electrician for a 220 VAC line. That move would be motivated by the completion of a newly home-brewed linear. The building of that piece of equipment is a story in itself.

Parts for that project were gathered piecemeal from a number of hamfest visits.

Others were acquired by some serious on-the-air and Internet horsetrading. The pole pig transformer, for example (which oozed transformer oil for years), was too large for any enclosure and relegated to a spot under the table.

It was connected to the primary via a length of three-conductor wire salvaged from an electric clothes dryer ready for the junk heap.

Connections to the power supply rectifiers were made using high-voltage wire strung out to the power supply chassis sitting on the shelf above. It was decided to use four 3B28s in a full-wave bridge because the tubes and the three filament transformers were purchased from a tailgater dirt cheap.

Two junker 50¢ bargain chassis, twice as large as needed, were used to mount the power supply and RF deck components. That tailgater was elated to see those clunkers go. Time passed, and after a series of mishaps, including poor solder joints, reversed diode polarity, and an endless number of adjustments, the legal limit station finally got on the air—with no pipsqueak signal. The project looked like hell and components and wires were everywhere, but no DX station cared. It was the signal that mattered and the QSOs netted in the pileups.

The bottom line was that no one could see it except the family members and they, for the most part, refused to go into that part of the house primarily because it insulted their sensibilities. So, depending on the eye of the beholder, this was the classic paradox: Is it beauty or the beast? Remember, ugly or not, the signal was up there with

Photo B. Apologies for not wearing a jacket and tie in the Dr. Jekyll station. It's obvious that order and neatness prevail. The absolutely necessary computer is sitting beside a newly restored Henry 2K-3. Barely visible behind the Henry is a Yaesu FT-840 and an FT-736. To the left of the Triplett meter is the master disconnect assembly. The meters in the black cases monitor both household current and voltage. Immediately behind me is a Command Technologies 2500 amplifier, an SP6, an FT-990DC and a Collins (round emblem) KWM2A.

the big boys and that's the ultimate reward.

In that light, it's perfectly OK to be considered Mr. Hyde's home away from home!

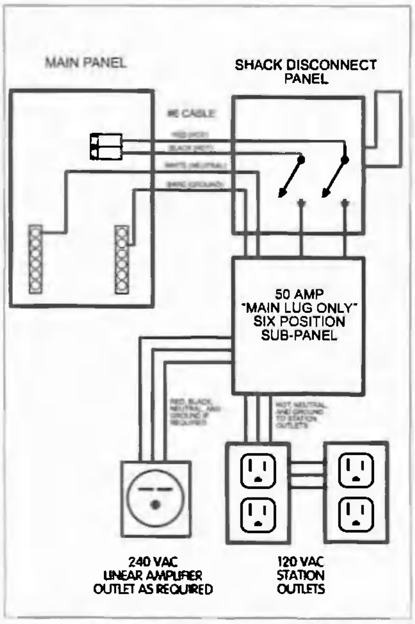


Fig. 1. Block diagram of shack disconnect system. See sidebar for details.

People say that neatness counts!

For a variety of reasons, some lucky amateurs get a chance to build a second shack. (Others get it right the first time.) Some get married, some change jobs and move, others divorce, or some on occasion acquire a second home (and a need for a second station). There's also a group that simply feels it's time for a change.

For whatever reason, a substantial percentage of them elect to follow a different construction format, making certain that all the mistakes previously made were cast out and only the best ideas incorporated into the new plan. The motivation to undertake this monumental task might have even come from a disgruntled spouse who, because of a bellyful of dust, disorder, and disarray, simply laid down the law.

The message was simple—*Clean up your act, or else!* So if you're starting out with a clean slate in a new location, and not tearing down what's already in existence, it's not terribly difficult to create your own private Utopia. Keep in mind that new construction is always easier than renovation.

Begin by setting up a proposed space that's not overly large. Remember—junk will expand to fit the area, so restrict yourself from the outset. Think carefully about the placement of furniture so that the space is best utilized. Generally a "U"-shaped area works well.

Visit the home improvement center and determine what's offered in assemble-it-yourself furniture. There's a whole array of knockdown computer- and office-type furniture that looks good and is relatively inexpensive. Plan the size of the room in order to accommodate your choices.

Once this is done, it's time to think seriously about your electrical power. Bring in a dedicated 220 VAC (#6 AWG) and a 110 VAC line (#12 AWG). Plan for a master disconnect box within the shack. (See the sidebar for a discussion of this aspect of the project.)

Don't forget to consider a source of heat to ensure your comfort during the winter months. A baseboard electric heater works well. If possible, an air conditioner helps get you through the dog days of summer. When the walls are open, it's a snap to install additional electrical outlets. A duplex box costs about 60¢, and a receptacle adds an additional 40. There's no excuse not to have them every couple of feet. It's far better than a twisted network of wires and extension cords.

Before the walls are closed up, bring in the telephone lines with four-conductor cable. Make certain to include an additional tap for the computer modem. The second twisted pair will accommodate a dedicated telephone if you eventually go the Internet route. While you're at it, include a couple of lengths of two-inch PVC to be used as behind-the-wall conduits in order to route the coaxial cable to the outside. Use PVC elbows to make the turn both at the inside floor level and out through the foundation. There's nothing more offensive to look at than four or five lengths of 8U cable and a hunk of ground cable strung across the wall, leaving the shack for the outside antennas through a couple of holes drilled through the window jamb.

Do It Right the First Time!

It makes good sense to plan from the outset for an adequate supply of electrical power to the ham shack. It's an equally good idea to do it right the first time and save the inconvenience and added expense down the line if you find you've outgrown the electrical capacity of the setup ... it happens all the time as newly purchased equipment is added to your inventory. Whether you're planning on undertaking the project yourself (to save some bucks) or hiring the job out, make certain it complies with the local electrical codes. Many localities allow the homeowner to undertake an electrical upgrade provided a permit is obtained and the job passes an electrical inspection. Check out the deal in your community. Keep in mind that any ham familiar with wiring up the simplest circuit can complete this job in a snap. Electricity should not frighten anyone, provided care is taken to prevent injury.

You'll have to start the project at the main panel. (See **Fig. 1**.) Use a 20 A SPST breaker and a length of #12 cable (two-conductor black/white + a bare ground) in this portion of the circuit to power the overhead lights, clock, handheld charger, electric pencil sharpener, etc. Run a second #6 (three-conductor red, black, white + bare ground) from a newly installed DPST 50 A 240 VAC breaker on the main panel to your shack location. Terminate this line in a DPST master disconnect switch box with an external shut-off handle. Keep in mind that only the "hot" black and red wires will be switched in and out of the circuit by the shut-off. The neutral and ground are always through-connected to the termination outlets and are never broken. To the master disconnect panel, close-couple a "main lug only" 50 A sub-panel. All the shack's outlets will be connected from this fused panel. I'd suggest that this box have provisions for at least six circuit breakers. For your 240 VAC linear amplifier electrical needs, install a DPST 240 VAC breaker. The breaker amperage is determined by the electrical needs of your particular amplifier; however, it's safe to assume that in the majority of installations 20 amps on each pole is sufficient. Needless to say, all bets are off if you're running a bunch of 4-1000As. You may have to wire up directly to the power company generators. When hooking up the 240 VAC outlet, make certain to include the neutral leg since many amps use 120 VAC (half the circuit voltage) to run fans, filament transformers, etc. For the other 120 VAC outlets that you want switched off at the end of the day, use a 20 A SPST breaker. Remember to wire them up to equalize the current draw on both sides of the neutral bar. You don't want to overload one leg of the circuit running back to the main panel.

Keep in mind that 240 VAC plugs and receptacles are configured to prevent either under- or overloading a circuit. You'll realize this if you ever tried to plug a table lamp into an air conditioner receptacle. If your 240 VAC linear does not have a factory-installed plug for you to match to a socket, determine the current rating from the manufacturer's specification sheet and purchase the appropriate plug and connector. In a nutshell, you'll not want to use a plug/socket combination from your electric clothes dryer on a solid state 600-watt amplifier. It's both impractical and expensive and could place your equipment at risk. The typical 120 VAC ham shack appliance generally offers no problems. Purchase the 20 amp duplex outlets. Plug your computer, transceiver power supply, and other gear into these switched receptacles. When you're ready to call it a day, one disconnect will remove all the expensive gear out of harm's way in the event there's a possibility of damage due to lightning storm activity.

A reminder!

You'll need to be reminded (visually) to shut off the main breaker when leaving the shack. To accomplish this quickly and easily, pick up a 120 VAC neon night light from your local department store. Leave this indicator permanently installed in one of the switched outlets. When the neon isn't glowing, you'll know that the expensive gear is out of the circuit. It's easy to see in the darkness when you shut off the light and nothing is glowing. This safety feature will save you a midnight, toe-banging, expletives-deleted, panic run to the shack to pull plugs when you're jolted out of a deep sleep by a severe electrical storm.

Give it a whirl. It's a great time- and equipment-saver and is probably the cheapest insurance you can buy to prevent electrical damage.

Consider a set of wires for an intercom so you can communicate with the rest of the house without having them bang on the ceiling to get your attention. After the drywalling, taping, and painting, lay down some inexpensive carpeting. It lends that touch of class, and more importantly keeps your legs from freezing in the winter.

Pick out your most prestigious awards and rarest QSLs and tastefully position them on the walls. They make a statement of accomplishment that's hard to beat. Purchase some inexpensive dimestore picture frames (black with gold leafing works particularly well) and matting to give the wall decorations additional ambiance. That's the way Dr. Jekyll would handle it.

Make certain that you have a comfortable (cushioned) high-back chair that is height-adjustable (especially if you're a dedicated brasspounder). It's nice if it swivels and allows for some

Continued on page 49

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the October issue, we should receive it by July 31. Provide a clear, concise summary of the essential details about your Special Event.

JULY 4

DILLSBURG, PA The 1998 July 4th Firecracker Hamfest will be held by the Harrisburg Radio Amateur's Club at Monaghan Fire Hall, 245 W. Siddonsburg Rd., Dillsburg PA (near Harris- burg). Traveling north on US-15: Pass traffic light and Chevrolet dealer on right in Dillsburg. Continue 1/2 mile past Harr's Drive-In. Turn right onto Siddons- burg Rd. Continue to the hamfest. Traveling south on US-15: Pass PA Turnpike entrance and Country Market to PA-114, Bowmansdale exit. Turn left at the stop sign onto PA-114. Continue 3 miles and turn right onto Siddonsburg Rd. Continue to the hamfest. Indoor air-conditioned table space. Tables, $15 each. General admis- sion $4, XYLs and harmonics free. Tailgating, $3 first space, additional spaces $5 each. Dealer setup Friday night 6 p.m.–9 p.m., Saturday at 6 a.m. Doors open to the general public at 8 a.m. VE exams at 9 a.m. For further info, contact the HRAC AnswerLine at (717) 232-6087; E-mail [fabinfo@ fabral.com]. To reserve tables, contact *N3NJB, 2501 S. 2nd. Street, Steelton PA 17113-3009; or E-mail [N3NJB@AOL.COM].* Talk-in on W3UU 146.16/.76 MHz.

JULY 10–12

DUNSEITH, ND The 1998 35th Annual International Hamfest will be held July 10th–12th at the International Peace Garden, between Boissevain MB and Dunseith ND. Camping on-site, forums, large flea market, transmitter hunts, mobile judging contest, dancing and socializing. The International Peace Garden Hamfest Committee is handling the arrangements. For more info, contact *Dave Snydal VE4XN, 25 Queens Crescent, Brandon, Manitoba, Canada R7B 1G1, (204) 728-2463; or Lynn Nelson WØCQ, 2700 23rd Street SW, Minot ND 58701, USA. Tel. (701) 839-8200.*

JULY 11

MILTON, ONTARIO, CANADA The 24th annual "Ontario Hamfest," which is being sponsored by the Burlington ARC, will be held at Milton Fairgrounds, Milton, Ontario. Open to commercial vendors at 7 a.m. (Robert St. gate only); tailgaters at 8 a.m. (Robert St. gate only); and the public at 9 a.m. (Thomas St. gate only). The C.L.A.R.A. Annual Picnic Meeting will begin at 11:30 a.m. Large indoor/outdoor flea market. For further info, contact *Burlington ARC, P.O. Box 85037, Burlington, Ontario L7R 4K3, Canada.* Take a look at the Web site, at *[www.bigwave.ca/~ve3coj/barc/].* You can also contact *Lorne VA3LOR at (905) 336-2999; E-mail [ve3coj@bigwave.ca].* Talk-in on VE3RSB 147.21 and simplex 146.52.

OAK CREEK, WI The South Milwaukee ARC will hold its 29th annual "Swapfest" at the American Legion Post #434 grounds at 9327 S. Shepard Ave., from 7 a.m. until at least 2 p.m. CDT. VE exams are pending. Free parking, picnic area, overnight camping. Admission $5 per person, which includes "Happy Time" with free refreshments. Talk-in will be on WA9TXE 146.52 simplex, as well as on many of the local repeaters. Get a free flyer by writing to: *The South Milwaukee Amateur Radio Club, Inc., P.O. Box 102, South Milwaukee WI 53172-0102. Tel. (414) 762-3235.*

PETOSKEY, MI The Straits Area ARC will host its 23rd Annual Swap & Shop on July 11th, 8 a.m.–1 p.m., at Emmet County Fairgrounds in Petoskey MI, US 31, 2 blocks west of 131. Admission $3 at the door, tables $5 (splits OK). VE exams at 1 p.m. in the American Red Cross Bldg. For VE exam info call *Floyd KG8CS, (616) 526-5503.* For more details, contact *Harry N8OIV at (616) 347-7771.* Talk-in on 146.68 and 146.52.

SALISBURY, NC The North Carolina Alligators Group will hold their Firecracker Hamfest July 11th, 8 a.m.–1 p.m. at the Salisbury Civic Center. From Interstate #85, West/East Innes St., turn left on South Boundary St. and the 'fest is on the left. Advance admission is $3 with an SASE, or $4 at the door. Always free to XYLs. The price of admission allows you to set up outside for the flea market. Tables in the air-conditioned center are $5. Dealers can set up on Friday from 3 p.m.–9 p.m. and check into the center at 7 a.m. on Saturday. There will be an auction of goods at 1 p.m. VE exams by TEARC/VEC on site at 10 a.m., walk-in only, no pre-registration. Applicants must bring original license, photocopy of present license, any CSCEs, and a photo ID to the exam session. For further details, contact *Rae Everhart K4SWN, P.O. Box 41, Lexington NC 27293-0041. E-mail [RAEF@infoave.net].* Talk-in on 146.520 simplex. For hamfest info, contact *Walter (Alligator) Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071. Tel. (704) 279-3391.*

TOMPKINSVILLE, KY The Monroe County ARC Hamfest will be held at the National Guard Armory Highway 163. Setup at 6:30 a.m.; doors open to the public at 8 a.m. Admission $5. Tables $7. VE Exams, walk-ins are accepted. Talk-in will be on the 146.775 rptr. For table info call *J. Bunch at (502) 678-5784; or E-mail David Welch K4PL at [dwelch@ glasgow-ky.com].*

JULY 12

AUGUSTA, NJ The Sussex County ARC will hold its 20th annual Hamfest at the Sussex County Fairgrounds, Plains Road, Augusta NJ, on Sunday, July 12th. Doors will open at 8 a.m. Registration is $5 per person (YLs and harmonics are free). Indoor table space, which is limited, will be available at $13 per table; outdoor selling space will be available at $10 per space. Talk-in will be found on 147.300 and 224.50 rptrs., and on 146.52 simplex. Contact *Daniel Carter N2ERH, 8 Carter Lane, Branchville NJ 07826. Tel. (973) 948-6999.*

BRUNSWICK, MD "SweatFest 98," sponsored by the Mid-Atlantic DX and Repeater Assn., will be held 7 a.m.–3 p.m. This year's event includes a tailgater area for ham radio, RC aircraft, RC cars, and model railroad hobbyists. ARRL VE exam session, ATV demonstration, and an RC aircraft demo will be featured. For more info, contact *MADRA SweatFest 98, (301) 473-4151; or E-mail to [madra@qsl.net].* Take a look at the Web page at *[www.qsl.net/ madra].*

KIMBERTON, PA The Kimberton Fire Company Fair Grounds, Rte. 113, south of intersection with Rte. 23, will be the location for a hamfest being sponsored by the Mid-Atlantic ARC. Indoor-outdoor space: tables 1–4 $10 each, 5 or more $8 each, not including admission. Indoor tables have electricity. Tailgating $5, no reserved tailgate space. Admission $5. Talk-in on 146.835(-) and 443.80 (+) CTCSS 131.8. Contact *MARC, P.O. Box 352, Villanova PA 19085; or call Bob Haase W3SA at (610) 293-1919; or E-mail [wb3joe@voicenet.com].*

PITTSBURGH, PA The North Hills ARC will hold its 13th annual Hamfest on July 12th, 8 a.m. to 3 p.m. at the Northland Public Library, 300 Cumberland Road, Pittsburgh PA. The hamfest is approximately 10 miles north of Pittsburgh on McKnight Road (Truck Route 19). At the 3rd traffic light after Northway Mall, turn left onto Cumberland Road. Northland is on the left at the top of the second hill. From points north, take Route 19 south toward Pittsburgh. Follow signs for McKnight Road, and at the 4th traffic light turn right onto Cumberland Road. If on Perry Highway, turn left onto Cumberland Road at the Sunoco. Talk-in and check-ins will be on 149.09 W3EXW, the North Hills Amateur Radio Club rptr. Free admission,

free parking. One free automobile-sized space per tailgater; each additional space $5. Handicap/wheelchair accessible. Contact *Bob Ferrey, Jr. N3DOK at (412) 367-2393*, or via E-mail at *[n3dok@pgh.net]* or through the North Hills ARC Web site at *[http://nharc.pgh.pa.us]*.

JULY 18

NEWPORT, NH The Sugar River Amateur Radio Festival, sponsored by Shklar & Lader L.L.P., Attorneys at Law, will be held on the Newport Town Common, 8 a.m.–3 p.m. Amateur radio, computers, and electronics will be featured. There will also be Packet Radio and Internet demos. All Scouts are invited for a Scout Ham-Boree. A Special Event Station will be on the air. VE exams will be given in the Sugar River Bank Community Room (rear lower parking lot entrance). Register for testing by 8:45 a.m. Food and refreshments will be provided by Newport Boy Scout Troop 316. Talk-in on 146.76 rptr., and 146.52 simplex. For further info, contact *Rob Boyd N1CIR, #648, Rt. 103, Sunapee NH 03782-3719. Tel./FAX (603) 863-5383; packet [N1CIR@WA1WOK.NH]*. Repeater: 146.76, Ascutney. Directions: From I-91 in Vermont—exit 8, 12 miles east on Rte. 11/103. From I-89 North in New Hampshire—exit 12, 8 miles west on Rte. 11. From I-89 South in New Hampshire—exit 13, 10 miles south on Rte. 10.

JULY 19

CAMBRIDGE, MA Tailgate electronics, computer and amateur radio Flea Market Sunday, July 19th, 9 a.m.–2 p.m., Albany and Main Sts., Cambridge MA. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Tailgate room for 600 sellers, sellers $10 per space at the gate, $9 in advance—includes one admission. Setup at 7 a.m. For space reservations or further info call *(617) 253-3776*. Mail advance reservations before July 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082*. This event will be held rain or shine! Talk-in on 146.52 and 449.725/444.725 pi 2A W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

SUGAR GROVE, IL The Fox River Radio League will hold their annual Hamfest at Waubonsee Community College, Rte. 47 at Harter Rd., Sugar Grove IL (5 miles NW of Aurora). Doors open Sunday at 8 a.m. Setup Saturday at 7 p.m., Sunday 6 a.m.–8 a.m. VE exams 10 a.m.; bring original license, copy of license and photo ID. Talk-in on 147.210(+) (pi 103.5/107.2). Contact *James Von Olnhausen N9UZC, c/o FRRL, P.O. Box 673, Batavia IL 60510. Tel. (630) 879-3042 or E-mail to [n9uzc@amsat.org]*.

VAN WERT, OH The Van Wert ARC will hold their 11th annual Hamfest July 19th at the Van Wert County Fairgrounds, US 127 South. Open 8 a.m.–3 p.m. Admission $5, parking free. Overnight $10. Some may set up Saturday evening after 7 p.m. if there is not a conflict with another activity on the Fairgrounds. Talk-in on 146.850/.250. VE exams given, with pre-registration by July 12th. Send SASE or call *Bob High KA8IAF, 12838 Tomlinson Rd., Rockford OH 45882. Tel. (419) 795-5763*. To reserve tables, send an SASE with your name and address to *VWARC, P.O. Box 602, Van Wert OH 45891-0602*. 8' tables $10, includes one free ticket. Extra tickets $5. Vendor setup is on Sunday at 6 a.m. Telephone *Bob WD9LPY at (419) 238-1877 after 5 p.m.* After July 6th, call *(419) 795-5763*.

WASHINGTON, MO The 36th annual Zero Beaters ARC Hamfest will be held Sunday, July 19th, 6 a.m.–2 p.m. at Bernie E. Hillerman Park. Commercial vendors, handmade quilts, computer and radio flea market, and more. Free parking. Free admission. Talk-in on 147.24(+) rptr. Watch for green-on-white hamfest signs. VE exam registration starts at 9 a.m. Walk-ins welcome: Limit 60. Bring original license and a photocopy. For more info, SASE to *ZBARC VE Exam, P.O. Box 24, Dutzow MO 63342*. For hamfest info, write to same address or call *Keith Wilson KØZH, (314) 629-2264; FAX (314) 629-1196. E-mail: [nØmfd@amsat.org]. Web site at [http://zbarc.usmo.com]*.

JULY 24–26

FLAGSTAFF, AZ The ARCA Fort Tuthill Hamfest, sponsored by the Amateur Radio Council of Arizona, will be held at Coconino County Fairgrounds in Flagstaff. Contact the ARCA at *(602) 779-2722 , or E-mail [arcathill@aol.com]*, for reservation info. Hamfest hours will be Friday and Saturday, dawn to dusk, and Sunday, dawn to 2 p.m. Admission is free. Tailgating spaces $15 before June 1st, $20 after June 1st. Nighttime camping $8. Dinner $15. Seminars, an ARRL forum, a ladies' program, Sunday Junque sale, and more, will be featured. VE exams Saturday, July 25th, registration is 8:30 a.m. to 10:30 a.m. You *must* have the original and one copy of your license and/or any applicable CSCE. Photo ID required. Walk-ins only. For exam info call *(602) 779-2722*. Talk-in on 146.980 requires 100 Hz pl.

JULY 25

WAYNESVILLE, NC The Western Carolina ARS of Asheville NC will host their 23rd annual Hamfest on July 25th at the Haywood County Fairgrounds in Waynesville (approx. 25 miles west of Asheville). Take exit 24 off I-40 then south on Hwy. 209 3 miles, or take exit 104 off US 19-23 then north on Hwy. 209 1 mile. Tickets are $4 in advance, or $5 at the gate. Commercial dealers, covered flea market, tailgating. VE exams. Free parking. The Haywood County Shriners will serve food and refreshments, with proceeds going to Shriners Children's Hospitals. For dealer and flea market info, contact *Chet Allen KE4VXC, (828) 258-3954. E-mail [KE4VXC@Juno.Com]*. For ticket reservations contact *Bob Helton KS4FX, P.O. Box 1488, Asheville NC 28802; E-mail [BHelton@interpath.com]*. For general info

contact *Tommy Queen K4BNP, (828) 258-2639; E-mail [K4BNP@aol.com] or [K4BNP@ Juno.Com].* Talk-in on 146.76/.91.

JULY 24–25

OKLAHOMA CITY, OK The Central Oklahoma Radio Amateurs will sponsor their 25th annual "Ham Holiday '98/ARRL State Convention" at the Oklahoma State Fair Park (Hobbies, Arts & Crafts Building), northeast of the I-40 and I-44 intersection. Doors open 5 p.m.–8 p.m. Friday, July 24th, and 8 a.m.–5 p.m. Saturday, July 25th. Technical and non-technical programs, foxhunt, WAS card check, VE exams, flea market. Pre-registration $7, $9 at the door. Flea market tables $10 in advance, $15 each at the door (if available). Electrical hookup $5. Talk-in on 146.82. Wouff Hong, midnight Friday. Additional info and registration forms are available on the CORA Web site *[www.geocities.com/heartland/7332].* Address other inquiries to *Ham Holiday '98/ARRL State Convention, P.O. Box 850003, Oklahoma City OK 73085; or E-mail [n1lpn@swbell.net].*

JULY 26

HONOLULU, HI In celebration of their third wedding anniversary, a grand Ham-Boree is being planned by Gordon Crowhurst G4ZPY and Brenda in the form of a big get-together of hams and their partners for an evening meal in Honolulu. They would like to put a face to a callsign, a face to a name, of their many friends and acquaintances all over the world. For those who are interested, there are a lot of nearby mountains for DXing on the Pacific Rim. For more info contact *G4ZPY Paddle Keys International, 41 Mill Dam Lane, Burscough, Ormskirk, L40 7TG England. Tel./FAX (44) (0)1704-894299* anytime until 2300, but not between the hours of 1600–1830 local time. Everyone must make their own holiday arrangements themselves and pay for their evening meal. Please R.S.V.P. so that a suitable location may be arranged for the get-together.

TIMONIUM, MD The Baltimore Radio ATV Society will hold its annual Maryland Hamfest and Computer Fest Sunday, July 26th, at the Timonium Fairgrounds on York Road off I-695, I-83. Free VE exams will be given at 9 a.m. only; check-in is at 8:30. Preregistration is required. To pre-register, call *John Creel WB3GXW after 6 p.m. at (301) 572-5124.* Vendors can set up beginning at 2 p.m. on Saturday. Tailgating area opens at 6 a.m. Sunday, indoor vendors open at 8 a.m. The event will be held rain or shine, and the fairgrounds is accessible to the handicapped. Admission is $5 per adult, children under 12 admitted free. Tailgating spaces are $10 each on a first-come, first-served basis with no advance reservations. Talk-in will be available on the 147.03(+), 224.96, and 448.325 MHz rptrs. See the BRATS Web site at *[http://www.smart.net/~brats].* You can contact them by E-mail at *[brats@smart.net];* or write to *BRATS Hamfest, P.O. Box 5915, Baltimore MD 21282-5915.*

AUG 1–2

JACKSONVILLE, FL The 25th annual Greater Jacksonville Amateur Radio & Computer Show will be held August 1st and 2nd at the Osborn Convention Center in downtown Jacksonville. The site is conveniently located one mile north of the I-95/I-10 junction. Take the Forsyth St. exit off I-95. Activities include forums and group meetings, a huge indoor swap area, and commercial exhibitor booths. Testing for all grades of ham license will be at 9 a.m. Sunday in the lobby area. Walk-ins are welcome. Hours are 9 a.m.–5 p.m. Saturday, and 9 a.m.–3 p.m. on Sunday. Exhibitor and swap area setup is Friday July 31st, 1 p.m.–6 p.m., with drive-in access for easy unloading. Admission is $8 at the door. Swap tables are $25 each for the weekend. Tables may be ordered from *Karl Hassler N4DHG, 2767 Scott Circle, Jacksonville FL 32223. Tel. (904) 268-2302.* Commercial booths are available via *Menard Norton KE4IOR at (904) 384-6750 or E-mail via [ke4ior@juno.com].* Headquarters hotel is the Jacksonville Omni with a special rate of $69 to those mentioning the hamfest. Phone *(904) 355-6664 or 1-800-843-6664* for reservations. Free parking is available in the main convention center parking lot and the entire hamfest is air-conditioned. Many alternative activities are available in the area. Talk-in is on the 146.76 rptr, or for more details, check the Web site at *[http://www.pobox.com/~w4ue/hamfest.html];* or write *Greater Jacksonville Hamfest, P.O. Box 27033, Jacksonville FL 32207.* The 1997 Greater Jacksonville Hamfest was designated the ARRL National Convention and the eight participating clubs plan an even bigger show this year. All proceeds go to upgrading amateur radio projects and activities in northeast Florida.

AUG 2

BERRYVILLE, VA The Shenandoah Valley ARC, of Winchester VA, will present the 48th Berryville VA Hamfest at Clarke County Ruritan Fairgrounds, 6 a.m.–3 p.m. Talk-in 146.830. Admission $5. Tailgaters $7 (indoor spaces available by reservation). VE exams by the Mountain ARC Teams. Contact *Tom Martin KF4TNX, (540) 323-0074. E-mail [hamfest@Vvalley.com], or write to Shenandoah Valley Amateur Radio Club, P.O. Box 139, Winchester VA 22604.*

ANGOLA, IN Land of Lakes ARC will sponsor a Hamfest Sunday, August 2nd, 7 a.m.–2 p.m. at Steuben County 4-H Fairgrounds, corner of 200 W. and 200 N., Exit 150 off of 69. Free parking, camping, chicken BBQ, swimming, amusement park and outlet shopping nearby. Indoor tables $8, trunk sales $2. Vendors setup Saturday, August 1st, 3 p.m.–10 p.m., Sunday, August 2nd, 4 a.m.–7 a.m. Not responsible for theft or accidents. Advance tickets $3, gate tickets $4. Advance sales end July 22nd. For more info, contact *Theresa J. Limestahl KB9NNR, P.O. Box 346, Fremont IN 46737. Tel. (219) 495-5403; FAX (219) 495-1675. Packet [KB9NNR@N9LCF].* Talk-in on 147.180 pi 131.8, 444.350, packet 145.510.

MARSHFIELD, WI The Marshfield Area ARS will hold their 7th annual "Hamnic" (a potluck dinner/swapfest) on Sunday, August 2nd, at Wildwood Park Shelter in Marshfield WI. Gather around 11 a.m. Talk-in on 147.180 or contact *Guy Boucher KF9XX, 107 West Third Street, Marshfield WI 54449. Tel. (715) 384-4323. E-mail [guyboucher@tznet.com]. Packet [KF9XXX@W9IHW.E5.AI.WI.USA.NA].* All are welcome!

RANDOLPH, OH The Portage ARC "Hamfair '98 For Radio Amateurs and Computer Enthusiasts" will be presented at Portage County Fairgrounds in Randolph (between Akron and Youngstown, on St. Rt. 44, 4 miles south of I-76). The event will take place from 8 a.m. to 4 p.m. Unlimited free parking. There will be indoor vendors and a huge flea market. Setup begins at 6 a.m. An on-grounds restaurant will serve breakfast and lunch. Advance tickets (available until July 15th) are $4; $5 at the gate. Other features include Worked-All-States card checking and ARRL officials to answer your questions and bring you up-to-date with what is happening. Indoor tables with electricity are $10 each. Flea market spaces $3 each. For reservations or info and tickets, contact *Joanne Solak KJ3O at (330) 274-8240.* Mail registration with a check/m.o. for the total amount, payable to *Portage Amateur Radio Club, 9971 Diagonal Rd., Mantua OH 44255.* Talk-in on 145.39 (-600 MHz). Get a look at the Web site at *[http://parc.portage.oh.us].*

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

OSCODA, MI The 1998 I.C.A.R.E. Hamfest will be held at Oscoda Airport in the Yankee Air Force Museum, Oscoda MI, 8 a.m.–2 p.m. Setup at 6 a.m. $3 trunk sales, tickets $4 in advance, $5 at the door. Tables $7 each. Free overnight RV parking available. VE exams with 9 a.m. check-in. Mail ticket orders with an SASE and payable to *I.C.A.R.E., P.O. Box 271, Oscoda MI 48750.* For more info, call *(517) 739-2896,* or *(517) 739-3129. E-mail [ka8aip@centuryinter.net].*

AUG 9

ST. CLOUD, MN The St. Cloud Radio Club will hold its 50th annual Hamfest on August 9th at

Whitney Senior Center, St. Cloud MN. VE exams begin at noon. Talk-in on 146.94 and 147.015. For info and tickets contact *WØSV, 401 Great Northern Dr., Waite Park MN 56387. Tel. (320) 255-1410. E-mail [jmaus@cloudnet.com]*. Check the Web site at *[WWW.WØSV.ORG]*.

AUG 18

ANGELS CAMP, CA The Calaveras ARS will hold an Amateur Radio Flea Market Saturday, July 18th, 7 a.m.–2 p.m. at Utica Park in Angels Camp. Buyers free! Sellers $5. Talk-in on 145.170(-) pl 100. For more details call *Steve at (209) 878-3829 or Susan at (209) 795-0618.*

AUG 29–30

BOXBOROUGH, MA The 1998 New England ARRL Convention at Boxborough MA will be held at the Holiday Inn Boxborough Woods Hotel and Conference Center, Route I-495. For information regarding exhibits, contact day or evening, *Anthony Penta W1ABC, General Chairman, 88 Hill St., Topsfield MA 01983. Tel./FAX (978) 887-8887. E-mail [tony@shore.net]*. For room reservations, contact *Mel Cole WZ1Q, Reservations Chairman, P.O. Box 8, Prides Crossing MA 01965. Tel. (978) 927-1953. E-mail [mel@shore.net]*. For exhibit and advertising info, contact *Richard Cosma KD1BF, Exhibits Chairman, 95 Higgins Road, Framingham MA 01701-4311. Tel. (508) 877-8241; FAX (617) 248-6939; or E-mail [kd1bf@amsat.org]*.

SPECIAL EVENT STATIONS

JULY 1–5

OSHKOSH, WI Radio Amateurs of Wisconsin, in conjunction with the Wisconsin Sesquicentennial celebration and the 27th annual Sawdust Days Festival, will operate W9W 1700–0200 UTC, in the General portions of 10, 15, 20, and 40 meters, SSB and CW. Send a 9 x 12 SASE for the certificate to *Mark Miller N9WT, 336 W. 8th Ave., Oshkosh WI 54901-5928 USA.*

JULY 4

DELTAVILLE, VA The Middlesex Amateur Radio Group (M.A.R.G.) will operate Station KB4NGO, from 1300 hours to 1900 hours on Saturday, July 4th, commemorating the annual Deltaville Heritage Day Celebration. Operation will be on the lower General 80–10 meter phone and CW. For a certificate, send a 9 x 12 SASE to *Fay Smith, P.O. Box 88, Hardyville VA 23070 USA.*

PLYMOUTH, MI The Stu Rockafellow ARS will operate station W8NJH for their 2nd annual "Salute to America's Small Towns," on July 4th. SSB target frequencies will be 7.270 MHz and 14.270 MHz. Hours of operation will be 1200 UTC-2000 UTC. For a certificate, please QSL with a 9 x 12 SASE to *Dave Langston KB8RAP, 1000 Town Center, Suite 1200, Southfield MI 48075 USA.*

JULY 11

BETHEL, CT Rare VHF grid square FN40 will be activated to coincide with the July 1998 CQ VHF contest weekend. The Candlewood ARA in Danbury CT will set sail for grid FN40, located just off the eastern tip of Long Island NY, on July 11th, 1998. Operation will begin before the contest period at 1300 UTC, and conclude at 2359 UTC, Saturday only. Contest class will be multi-operator class 2. Packet cluster spots will be through YCCC and Tri-State networks. The club call, W1QI, will operate simultaneously on the 50, 144, 220, and 432 MHz bands, using SSB primarily, with some CW and FM. Output will range from 50 to 150 watts to single yagis mounted on one or two small boats (sorry ... the cruise ships were all booked!). Plans and operating details will be posted as they develop on the CARA Web page at *[http://www.danbury.org/org/cara/]*.

JULY 11–12

KALAMAZOO, MI The Southwest Michigan Amateur Radio Team (SMART) will sponsor a special event station starting July 11th at 1800Z–0200Z July 12th. The station will be located in Kalamazoo MI and will operate under the new club call K8KZO. All contacts will be in the phone bands on or around 3.904, 7.2704, 14.304, 28.304, and 147.04. This event is to celebrate the 40th anniversary of SMART. To obtain a certificate confirming the contact, send a QSL and a 9 x 12 SASE to *SMART, P.O. Box 3175, Kalamazoo MI 49003-3175 USA.*

JULY 19

STRATFORD, NY The Fulton County Dr. Mahlon Loomis Committee will operate Station W2ZZJ on July 19th to commemorate the 172nd Anniversary of the birth of Dr. Loomis, the American radio pioneer who was born at Oppenheim NY on July 21st, 1826. Operation will be from 1300–2000 UTC on the General class phone portion of 75, 40, and 20 meters; and on the Novice 10 meter phone band. Also, on area 2-meter FM repeaters. For a parchment certificate and extensive literature, send QSL, contact number, and a #10 SASE (55¢ postage) to: *George P. Sadlon W2ZZJ, 5738 St. Hwy. 29A, Stratford NY 13470 USA.*

JULY 26–AUG 8

KINCARDINE, ONT., CANADA The Kincardine DX Group will operate XK3K to celebrate the 150th Anniversary of the Town of Kincardine. This special callsign will be used between 0000 UTC July 26th and 2359 UTC August 8th. Operations will be on all bands 80–10 meters, SSB and CW. Please send an SASE for QSL to *Bill Hardie VE3EFX, 755 Johnston Crescent, Kincardine Ontario N2Z 1S5, Canada.*

JULY 31–AUG 2

OSHKOSH, WI The Fox Cities ARC of Appleton WI will operate W9ZL from the Experimental Aircraft Assn. Fly-In and Convention (EAA AirVenture '98) at Wittman Regional Airport in Oshkosh. SSB-HF operation will begin on Friday, July 31st and continue through Sunday, August 2nd, in the General portions of the phone bands. RTTY operation

Continued on page 78

Mega-Mini Micropower Timeout Switch

Here's a great excuse to play with SMT.

Sam Ulbing N4UAU
5200 NW 43rd Street
Suite 102-177
Gainesville FL 32606
[n4uau@afn.org]

What's one-sixth the size of a postage stamp, draws about 10 microamps and gives delays from seconds to hours?

This timeout circuit!

$2.50. That's how much it cost every time I had to replace the nine-volt battery in my DMM (digital multimeter), and I was getting tired of replacing it every month or so. Of course, the battery should last a lot longer, but I have a bad habit of forgetting to turn off the meter when I am done with it. In a few days, the battery is pretty well run down. My inexpensive calculator has an automatic shutdown, so why not make one for my DMM? Then, if I leave it on by mistake, it will shut itself off after a few minutes.

I envisioned a circuit small enough to put in the battery compartment of the DMM and of low enough power to not run down the nine-volt battery. It took some time and a bit of experimenting to find the proper parts to build a circuit that would meet these criteria, but I now have a neat automatic shutdown switch. As an unexpected bonus, I also have a "soft" On/Off switch that is much easier to work than the rotary function switch on the meter. The project seemed simple enough, but it turned out to be a lot more sophisticated than I thought it would be. In the process of building it I learned a lot about ultra-low current ICs, which will be useful as more new low power ICs are introduced.

Early attempts were unsuccessful

My first thought was to use an LM555 timer in a one-shot (monostable) configuration as shown in **Fig. 1.** This is a common application of the 555, but for me it had two drawbacks. First, the timing graph showed that I would need a 10-megohm resistor and a 50-µF capacitor to get a shutdown delay of seven minutes. Such a physically large capacitor would not fit in my battery compartment. Worse, the chip drew 5 mA (more than the meter itself) and since it would be connected to the battery all the time, I'd run my battery down in only four days.

I considered an LMC555, the CMOS version, which uses only 0.25 mA maximum, but it would still run the battery down in about two months.

I thought about using the ICL7660 and four AA batteries to power the setup as I had for the digital ammeter on my boat (see "Penny Pincher's Digital Ammeter," *73*, May 1998). That approach would not power the meter down, but four AA batteries would have more capacity or I could use rechargeable batteries. That would work, but the arrangement would be bulky and I would have to strap the batteries to the back of the meter. Not a very neat or easily portable solution.

Another solution I thought of was to use a small microcomputer chip as a timer, but this seemed to be overkill for what should be a simple job. Besides, it would probably use too much current and be too big to fit inside my meter.

My battery-saver project went on hold for a couple of years until I discovered the LMC7221. As a National Semiconductor ad says, "With the right parts, you can do anything." And this was the right part for my project. It is one of a family of micropower op

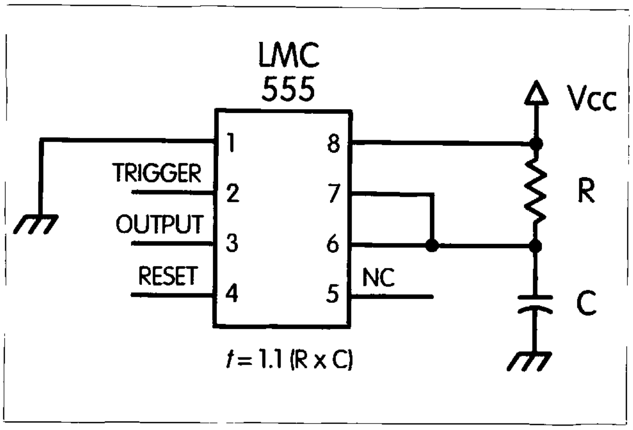


Fig. 1. Typical timeout circuit using LMC555.

amps and comparators for applications in "mobile phones, pagers, notebook computers, Personal Digital Assistants, and PCMCIA cards."

The LMC7221 is a comparator with an open drain output (there is also a 7211 with a push-pull output) that can operate with voltage sources from 2.7 to 15 volts. It has a maximum supply current of 18 microamps, so it can run for at least 24,000 hours, or nearly three years, before it drains a nine-volt battery. The chip is available in DIP, SO-8, and SOT23-5 packages. Since I had a sample of the SOT23-5 chip, I decided to use it. The entire circuit fits on a PC board one-sixth the size of a postage stamp (see **Photo A**).

The circuit

Fig. 2 shows my auto shutdown circuit. U1 is the comparator with an open drain output. The output is low when the inverting (-) input is greater than the noninverting (+) input. When the inverting input is less than the noninverting one, the output goes into a high impedance state. The circuit uses the chip as a low side switch. Timing is set by an RC circuit (R3 and C1). The timer is started by pushing PB1, which charges C1. R3 then discharges C1 until its voltage is less than that set by the voltage divider, R1 and R2, at which point the switch turns off. Pushing PB2 will manually shut down the circuit by discharging C1.

Easy, isn't it? Yes and no. Recall that when I thought about using the LM555, a delay of seven minutes required a 50-µF capacitor and 10-meg resistor. This same RC "time constant" also applied to my circuit, and if I had to use such a large capacitor, I would not be able to make the circuit small enough. (Recall that one time constant = RC, which equals the time needed for a charged capacitor C to discharge to 37% of its initial voltage through a resistor R, where R is in ohms, C is in farads, and T is in seconds.)

Fortunately, the LMC7221 characteristics allow the use of a much smaller capacitor. The LMC7221 datasheet shows that the current at the + and - input pins is typically 40 *femto*-amps. That's 40 quadrillionths in layman's terms, or 40 x 10^{-15} amps, or .00000004 of a *micro*amp. The input uses so little current that you can almost count the electrons as they go by (see sidebar, "How Many Electrons Is That?"). Since R = V/I, the input resistance (at nine volts) is more than 0.225 x 10^{15} or 225 million megohms. That is a *lot* of resistance and it allows some interesting possibilities.

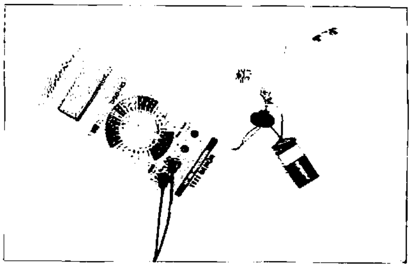


Photo A. A postage stamp is about six times larger than the completed circuit to its right.

Compare that to using a chip like the LMC555, which has a maximum leakage current at pins 6 and 7 of about 100 nanoamps (10^{-7}). That is "only" 90 megohms at nine volts. This "low" resistance sets an upper limit on the value of the timing resistor in the RC circuit. A 10-megohm resistor is about 10% of the leakage resistance. Using the same upper limits with the LMC7221 circuit allows the use of a two-million-megohm resistor (2 x 10^{12}). This is half a million times as large, and hence for an identical time constant we could use a capacitor half a

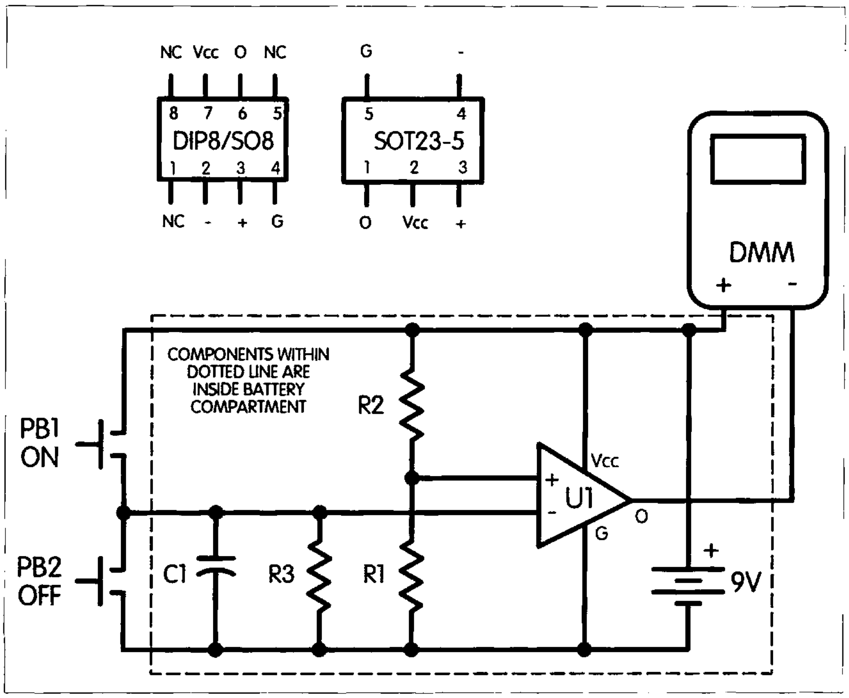


Fig. 2. Schematic of automatic shutdown switch.

Capacitor	Minimum R per Catalog (megohms)	Test Results (megohms)
0.1 µF ceramic	2000	2600
0.1 µF ceramic monolithic	2000	50,000
0.22 µF ceramic SMT	2000	30,000
1.5 µF tantalum	800	16,000
1 µF electrolytic	2.2	55

Table 1. Capacitor test results.

million times smaller (about 100 picofarads)!

Selecting the components

I did not use those values, however, not only because I could not find a two-million-megohm resistor but also because at such large values leakage current becomes a significant consideration. PC board insulation resistance typically ranges from 10^7 to 10^{16} ohms (from *Low Level Measurements*, 4th edition, Keithly Instruments, Inc., p. 4-22). Nearly everything in the environment will have a significant impact on the number of electrons leaking out of the capacitor and thus cause unpredictable behavior.

An RC circuit with a small capacitor and large resistor uses very small currents. For this reason, the leakage current of the capacitor itself becomes an important consideration. A leaky capacitor acts like a perfect one with a resistor across it. Electrolytic capacitors are notoriously "leaky," while ceramic, tantalum, and polypropylene capacitors are generally better.

Table 1 shows leakage resistance values for several different capacitors. The catalog data gave minimum values. To get a feel for actual resistance, I ran an experiment on several capacitors I had on hand. (The sidebar "More Technical Information for the Experimenter" contains more on my testing methods.)

Measuring the leakage resistance of capacitors is not a job that can be accurately done with ordinary equipment, due to the very large values involved, and there are many factors which make accurate measurements difficult even with expensive equipment. Nevertheless, I found it was possible to get a rough feel for the relative resistances and this was all I needed to build my switch.

The biggest surprise was that a ceramic capacitor I had from a surplus place "leaked like a sieve" but the SMT (surface mount technology) ceramic and the monolithic ceramic capacitors had very high leakage resistance. The electrolytic capacitors were the worst, as expected. I decided to try both the tantalum and one of the better ceramic capacitors.

Four components set the shutdown time: R1, R2, R3, and C1. I wanted the meter to shut down after about 5 to 10 minutes. Using an Excel® spreadsheet (see sidebar "More Technical etc." and **Table 2**) to solve the discharge equation for an RC circuit, $V = E * e^{-t/RC}$, I found that a 1.5-µF capacitor and 2,600-meg resistor would work by setting R1 and R2 so that C1 discharged to 91% of its initial voltage. Or, a 2,600-megohm resistor would work with a .22-µF capacitor discharging to half its initial value. But where to find a 2,600-megohm resistor?

The ultimate large resistor would be to just let the IC input pin resistance and the capacitor internal resistance act as R3. It seemed that the leaky 0.1-µF ceramic capacitor should work by slowly discharging itself, but I found that the shutdown time was very unpredictable. The values for the tantalum and other 0.1 capacitors were

How Many Electrons Is That?

Working with such large numbers, I wondered just how many electrons were involved. This is not an idle question, since one of the major efforts in computer electronic design these days is to reduce both the distance of electrical paths (to make computers run faster) and the number of electrons involved (to help them run cooler). Ideally, the goal would be to have no distance and only one electron to represent a "one" and no electrons to represent a "zero."

A search on the Internet revealed that one coulomb = 6.25×10^{18} electrons. I already knew that one amp equals one coulomb per second. So 40 femtoamps is 6.25×10^{18} times 40×10^{-15}, which equals a mere 250,000 electrons per second. That's the maximum amount of electrons that will leak out through the input pin.

A quarter of a million may still seem large, but compare that with the number of electrons for one microamp, which is normally considered a very small current with 6,250,000,000,000 electrons per second. In perspective, 250,000 is getting very close to that single electron.

I also wondered how many electrons were in a capacitor when it was charged to nine volts.

The equation for that is:

Coulombs = Capacitance x Voltage

For our 1.5-µF capacitor, there are 13.5×10^{-6} coulombs, or 84.3×10^{12} = 84,300,000,000,000 electrons.

Using the just the LMC7221 input pin, and with no other leakage effects, it would take about *10 years* for the 1.5-µF capacitor to discharge.

While I was working on my switch, I happened to note in *Electronic Engineering Times*, Jan. 5, 1998, that in a recent breakthrough researchers have fabricated a single-electron transistor. One of the researchers commented that "the single-electron effect is going to dominate transistor design regardless of whether we like it or not. The question is how do we take advantage of it." I think this project is just such a step!

Shut-off voltage (at non-inverting pin) for different values of R1 and R2 (Vcc = 9)			Voltage on C1 for different % of the time constant		Time to reach t/RC for different R and C values				
					R3 = 2600		R3 = 2600		R3 = 10
					C1 = 1.5		C1 = 0.22		C1 = 1.0
					R3C1 = 3900.0		R3C1 = 572.0		R3C1 = 10.0
					Time		Time		Time
R2	R1	Shut-off voltage	t/R3C1 (%)	C1 voltage	Sec.	Min.	Sec.	Min.	Sec.
1	10	8.2	0	9.0	0	0.0	0	0.0	0.0
2	10	7.5	1	8.9	39	0.7	6	0.1	0.1
3	10	6.9	2	8.8	78	1.3	11	0.2	0.2
4	10	6.4	3	8.7	117	2.0	17	0.3	0.3
5	10	6.0	4	8.6	156	2.6	23	0.4	0.4
6	10	5.6	5	8.6	195	3.3	29	0.5	0.5
7	10	5.3	6	8.5	234	3.9	34	0.6	0.6
8	10	5.0	7	8.4	273	4.6	40	0.7	0.7
9	10	4.7	8	8.3	312	5.2	46	0.8	0.8
10	10	4.5	9	8.2	351	5.9	51	0.9	0.9
10	9	4.3	10	8.1	390	6.5	57	1.0	1.0
10	8	4.0	20	7.4	780	13.0	114	1.9	2.0
10	7	3.7	30	6.7	1170	19.5	172	2.9	3.0
10	6	3.4	40	6.0	1560	26.0	229	3.8	4.0
10	5	3.0	50	5.5	1950	32.5	286	4.8	5.0
10	4	2.6	60	4.9	2340	39.0	343	5.7	6.0
10	3	2.1	70	4.5	2730	45.5	400	6.7	7.0
10	2	1.5	80	4.0	3120	52.0	458	7.6	8.0
10	1	0.8	90	3.7	3510	58.5	515	8.6	9.0
			100	3.3	3900	65.0	572	9.5	10.0
			110	3.0	4290	71.5	629	10.5	11.0
			200	1.2	7800	130.0	1144	19.1	20.0
			250	0.7	9750	162.5	1430	23.8	25.0
			300	0.4	11700	195.0	1716	28.6	30.0
			400	0.2	15600	260.0	2288	38.1	40.0
			500	0.1	19500	325.0	2860	47.7	50.0
			600	0.0	23400	390.0	3432	57.2	60.0
			700	0.0	27300	455.0	4004	66.7	70.0

***Table 2.** Spreadsheet for determining components for desired shutoff times.*

much too large, and tests showed that the circuit stayed on for very long times.

As I was pondering this dilemma, I recalled that the small 1N4148 diode passes a very low current when reverse biased. Datasheets showed a maximum reverse current of 25 nanoamps at 25° C and a typical current of six nanoamps. That seemed like a large variation and I knew that the current was quite temperature-dependent, so I decided to measure a few of the ones I had.

The results are in **Table 3**. These values were near the values I needed, but

Continued on page 46

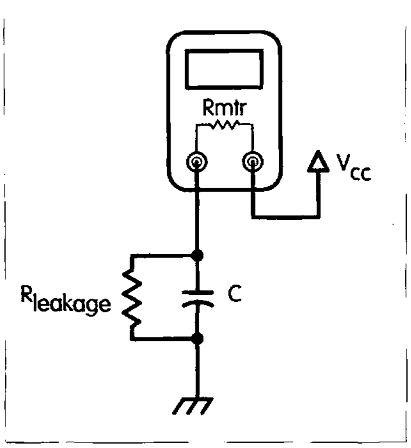


Fig. 3. Using a 10-megohm DMM to measure very high leakage resistances.

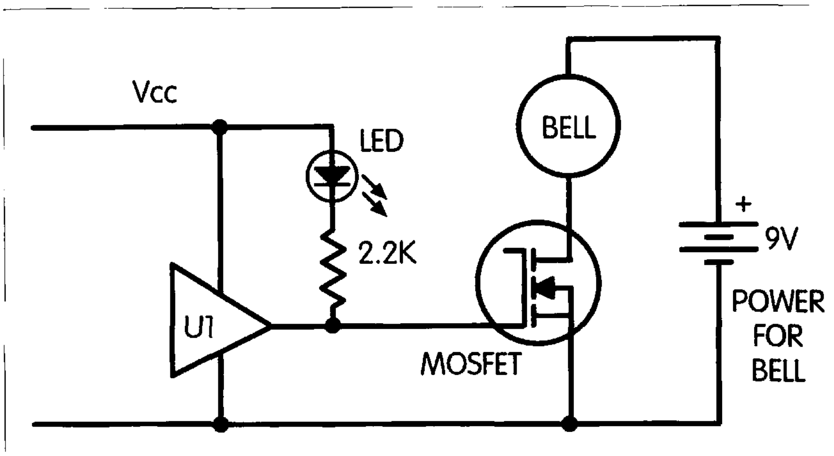


Fig. 4. Test setup for breadboard timing tests.

Mega-Mini Micropower Timeout Switch

continued from page 45

with such a large range of values I would have to select the specific diode to use.

Prototyping and the final circuit

I made several prototypes. For the first one, I set R1 at 10 megs since it was the largest value resistor I could find in the catalogs. By using this value, I would limit the current flow through R1 and R2 to 1 µA. I set R2 at 1 meg because I had a small SMT resistor of this value. Combined with the 1.5-µF tantalum capacitor, the circuit worked well. It was small and drew only 9.4 µA, but after I built it, I wondered if I could improve it. I made a version using a 0.22-µF SMT capacitor and two 10-meg resistors that also worked well. It was a bit smaller and drew only 9.1 µA.

It's funny how the mind gets stuck in a rut. I suddenly realized that I was trying to minimize current through the R1-R2 branch but was limiting my thinking to "standard" resistors. I had just learned that a reverse diode would work as a resistor, so why not make R1 and R2 with reverse diodes which are cheap, small, and have a lot more resistance than my standard resistors? In order to do this, it was necessary to measure a bunch of diodes and select two that had about the same reverse resistance (for a 50% voltage divider). I did this, and found that the circuit worked fine—and drew only 8.7 µA.

Since accurate measurements were not possible, I used the "try it and see" method with the DIP version of the IC to select the actual components for my final version. I breadboarded the different circuits and ran timing tests. Each circuit had a slightly different shutdown time and none was "clock-like" in accuracy, but all three were within the five-to-10-minute range I wanted and none varied more than about a minute. This timer would not be suitable as a mass-produced circuit, but as a custom one with selected parts it works very well.

I made my "final" version on a single-sided piece of PC board measuring 9 mm by 10 mm—only slightly larger than a DIP IC! I used two 1/8-watt resistors, an SMT capacitor, and a 1N4148. My technique for making an SMT PC board is described in "A Pentium-Style Positive and Negative Power Supply," *73*, June 1998. I was delighted to find that using the SOT23-5 version of the chip was not much harder than building with the larger SO-8 since there are only two

Diode	Current (nanoamps) 9 V & Room Temp.	Resistance (megohms)
#1	3.8	2300
#2	2.6	3300
#3	1.2	7100
#4	2.8	3000
#5	1.4	6000
#6	0.8	10,900

Table 3. Diode test results.

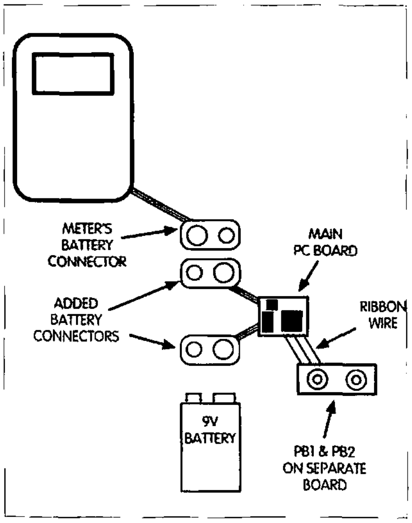


Fig. 5. The completed circuit is easy to connect.

More Technical Information for the Experimenter

Measuring and using very large resistances

With a meter that only measures to 2000 megs, I needed a different way to measure the resistances involved. The method I used is similar to the one I use for very low resistances. I measured the voltage across a resistor in series with the one I wanted to determine. I then calculated the current through that resistor and with that I was able to calculate the unknown resistance. The resistance I used was the DMM internal resistance measured as 9.9 megs. Putting the meter in line as shown in **Fig. 3** is like placing a 9.9-meg in series. I determined the meter resistance by using a 1-meg 1% resistor in series with it.

The equations are:

$I = V_{measured}/R_{meter}$.

And the unknown resistance is

$R = (V_{cc} - V_{measured})/I$.

With the 1.5-µF tantalum capacitor, I measured 5.45 mV, giving a current of 5.45×10^{-10} amps. With only 5.45 mV across the meter, essentially the entire source voltage (8.47 volts) was across the capacitor. Thus the resistance of the capacitor was $8.47/(5.45 \times 10^{-10}) = 1.554 \times 10^{10}$, or about 16,000 megs.

Due to capacitance and dielectric effects, it takes some time for the current to charge the capacitor and reach its leakage value. For a 1% accuracy, you need to wait at least five time constants, which for a 10-meg resistor and a 1.5-µF capacitor is about two minutes (with no absorption). Notice that you cannot use a DMM to measure the voltage across the capacitor directly since the meter resistance is much less than that of the capacitor. The high resistances of a couple of the capacitors I measured caused readings so small (1 mV or less) that noise and meter error prevented really good readings—but at least I knew these capacitors had a very large resistance.

High-value resistors require careful handling. Surface films from moisture or careless handling can reduce the resistance by increasing surface current flow. I tried some SMT diodes and found the shutdown time was less than expected. Since the solder contacts are next to the surface, I suspect that surface currents were present.

Using a standard 1N4148 diode as a resistor has worked well for my meter. For other applications, it is important to recognize that the resistance of a diode varies with temperature. According to National Semiconductor, a rule of thumb is that the reverse current through it will double with every 10° C increase.

Dielectric absorption

Low Level Measurements (see text) notes the following: Dielectric absorption occurs when randomly-oriented permanent dipoles of molecules within a capacitor dielectric are aligned by an applied electric field. For timing this can seriously degrade the accuracy of the circuit. This absorption must be known and compensated for if you want an accurate circuit. Dielectric absorption is not normally specified by a manufacturer. A test for dielectric absorption is to charge a capacitor through a resistor for one or two minutes and then discharge the capacitor through a resistor for a short period. Then let it sit for a couple of minutes and measure the voltage. This voltage is a measure of the dielectric absorption.

To measure the voltage on a capacitor, however, it is necessary to have a very high impedance meter—a common DMM will not work. I made a "jury-rigged" high impedance buffer using one of National's high impedance op amps, LMC6082, and was able to get a feel for dielectric absorption. I found that some of the larger tantalum capacitors had a large dielectric absorption, their shutdown times in my timing tests differing significantly from what was predicted.

Using an Excel spreadsheet to determine components

Table 2 shows the spreadsheet I used to select the values for my circuit. The left-hand side gives the voltage at the noninverting input for various R1, R2 combinations with V_{cc} = 9 volts. With R2 = 1 meg and R1 = 10 megs, the voltage is 8.2 volts. The next two columns show the results of the capacitor charging equation: the voltage on C1 for different percentages of an RC time constant. Note that C1 reaches 8.2 volts after 9% of a time constant. The next columns solve for the time in seconds and minutes for certain R and C combinations. For R3 = 2,600 megs and C1 = 1.5 µF, 9% of a time constant is 351 seconds (six minutes), which is what I wanted. Using R3 = 2,600 megs and C1 = 0.22 µF, six minutes was 60% to 70% of a time constant. C1 will be at 4.5 volts and setting R1 = R2 = 10 megs gives 4.5 volts.

Note also that after five time constants (500%), the capacitor is nearly fully discharged.

It is easy to make a spreadsheet like I did since the function for e^x is part of the function library of Excel. If you don't have Excel, you can use the last column and ratio the results for R = 10 and C = 1 for other values.

Using a DIP chip

I breadboarded my test versions on a regular breadboard using a DIP chip. This is certainly not the best way to get a repeatable results, however, and it is likely to be a major cause of my variable results. If you decide that you want to make a circuit with the DIP package, keep in mind a technique suggested in one of the National Semiconductor datasheets. They suggest bending the input pins and using what hams call "ugly construction," with the components connected directly to the pin. As they note, air is an excellent dielectric.

An alarm

I used an LED and resistor for the output load during breadboard tests. Sitting around waiting for the LED to turn off was boring, to say the least. I devised an alarm by connecting a MOSFET to the output of the comparator. When the LED went off, the bell turned on (**Fig. 4**).

critical cuts to make. Perhaps this is also because I have now done three projects with SMT parts. My first one, an audio amplifier ("SMALL—a Surface Mount Amplifier that is Little and Loud," *QST*, June 1996) was on a 21 mm by 26 mm PC board. At the time I thought it was as small as I could go, yet this one is only one-sixth that size. Practice must help!

Exact PC board layout depends on what components you use. I put the On/Off switches on a separate piece of PC board and connected them with a three-wire ribbon cable so that I could mount the switches on the front of the meter. While a power supply bypass capacitor is generally used with comparators, I did not use one and have seen no problems—perhaps because the circuit is so close to the battery.

Other uses

I am already thinking of other uses for this nifty chip. I could use it (with other parts) to have an AC lamp shut itself off. Power MOSFETs come in very small packages now, so an ultra-small high current switch is also possible. I could build an intruder alarm and have it shut down after a few minutes.

Another intriguing possibility is for very long time delays that are not feasible with lower-resistance ICs. By making C1 = 3.3 µF and R1 = R2 = 10 megs, I made a 90-minute timer. It should be possible to extend that time to five hours by making R1 = 1 meg and R2 = 10 megs. The chip will operate on voltages as low as 2.7 volts, and I breadboarded a switch powered from a single tiny lithium battery cell which worked. The battery should last several years. All of these options will take a bit of experimenting to get the best circuit, but then, isn't that what ham radio is about? I would like to hear from anyone who experiments with this chip. I wonder if there are better small capacitors available and if there is a better way to make high value resistors.

I have been using my new switch for about six months now. I find that with the "soft" On/Off push-button switches, I tend to turn off the meter more often because it is so easy. When I forget, though, the circuit reliably shuts down my meter—just as planned.

Home-Brew RF Ammeter for the Shack

continued from page 30

two turns instead of the wire straight through the core.

Q. I use open wire feeders. Do I have to build two of these units?

A. Actually, this is "builder's choice," but not necessarily. You can duplicate the rest of the circuit and use a dual pot, switching the single meter from one side to the other, but (although I haven't tried it; I use coax) probably one in either side of your feeder pair would serve as well.

Q. How do I know this simple unit will work? How did you test it?

A. My antenna, about 10 feet high and which runs through an avocado tree and resonates at about 12 MHz, fed by my QRP++ through my home-brew low pass antenna tuner, which also includes a cross-needle meter, was used to check operation of this RF ammeter on all bands 40 through 10 meters, the only bands I operate. There is no reason it should not function as well on 160 and 80 meters.

Final thought: Build one (or two) RF ammeters, and then sell your SWR meters to hams who didn't read this article.

Take the Jekyll and Hyde Test

continued from page 37

reclining. These executive chairs can be expensive, so check discount office suppliers for a good deal. Whatever the cost, it's worth the added expense.

So what's the bottom line?

It is difficult to present a convincing argument for either the Jekyll or Hyde ham shack designs by stating unequivocally that one is better than the other. There are probably just as many amateurs who will make a case for either extreme, so the safest bet is to adjust your sights for a compromise plan but make certain to include all the safety and as many of the comfort features as you can. Think about your current space requirements and make certain to allow for some room to expand if you decide down the road to become involved in a new dimension of the hobby.

Remember: If that occurs, you're off again with a component here and a piece of gear there, and before you know what's happening, Mr. Hyde is rearing his ugly head!

QRX

continued from page 8

The Netherlands. The European Radiocommunications Office (ERO) has been instructed to officially notify the FCC of the decision approving US participation.

The State Department's action came at the urging of the ARRL that the US take advantage of the CEPT Recommendation T/R 61-01 arrangements and issue a license that would be recognized by CEPT-participating administrations and would be valid for brief visits.

Also, last fall the FCC proposed amending the amateur radio rules to make it easier for hams holding a CEPT license or an International Amateur Radio Permit (IARP) to operate during short visits to the US.

Under the arrangement, a US Technician license would be recognized as a CEPT Class 2 (VHF only) license, with full privileges above 30 MHz. Holders of Tech Plus through Extra tickets would be given a CEPT Class 1 license, with full privileges on HF and VHF. Novice licensees would not be eligible for a CEPT equivalent license since most CEPT countries don't offer a license of this type.

Once the ERO formally advises the FCC of the decision, the FCC must complete the steps to implement the participation before CEPT licensing can become effective.

Space Station Launch Delayed Again

Space agency officials from around the world met in May at Cape Canaveral, Florida, to discuss a new launch timetable for the International Space Station. The launch of the ISS has been delayed once again, this time due to space hardware production problems in Russia. While the first modules of the ISS are still slated to be launched later this year, Russia admits that it is far behind schedule in finishing its main contribution to the station. A top Russian space official has told the press corps that the launch of the new station's first module will have to be pushed back into late autumn of 1998, because his nation had

Continued on page 77

Number 50 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

Making antenna measurements

This month I want to describe some experiments with microwave and VHF test equipment and antennas that were covered at one of our San Diego Microwave Group meetings at Kerry N6IZW's home. These experiments covered some of the most basic of all antenna principles, demonstrating them on small models. The ability to see on a small-scale equivalent proved invaluable; it clarified our understanding of antennas and effects that demonstrate antenna principles.

We all are aware of these basic principles, like put the antenna in the clear at least one-quarter wavelength above ground, place it away from obstructions in the transmission path, and on and on. I, too, have been pretty much aware of what I have read, but due to the sheer size of antennas and their supporting structures, I don't have the space/time/inclination to test these principles. I just put up the best antenna and structure that I can manage and let it go at that point.

The antenna test range

A short antenna demonstration range was set up on a tabletop showing how RF propagation is affected, and some principles applied to its path losses from source (transmitter) to destination (receiver). 10 GHz microwave frequencies were used in this demonstration, which allowed a tabletop to function as the test range. The table, being about five feet long, provided a test range nearly 70 wavelengths long, making a good evaluation on a simple basis. 300 million divided by a frequency of 10250 MHz equals .29 meters or 3 cm (1.14 inches) for a wavelength at 10250 MHz. See **Fig. 1**.

Does this make any sense when you think about a 10 GHz waveguide (wavelength being one inch and waveguide for 10 GHz being one-half by one inch in physical size)? With a wavelength being about an inch and the table being five feet long, each inch of that separation is equivalent to a full wavelength of RF radiation between antennas. Try that at 40 meters—if you do, you'll need the entire farm and *that* might not be enough.

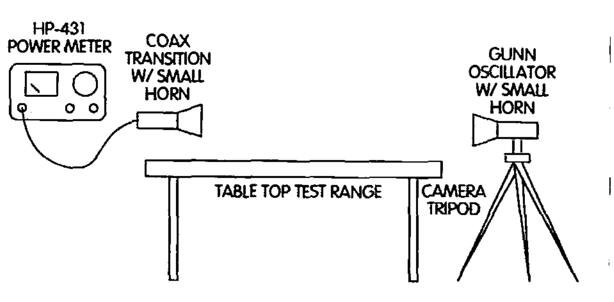


Fig. 1. Antenna test range constructed on a tabletop. The microwave power meter is located on one end and the test transmitter (10 GHz Gunn oscillator located on small camera tripod) is on the other end of the test range.

The tabletop test

The tabletop antenna test range was set up to have a microwave power meter connected to a coaxial waveguide transition and a small horn antenna at the head end of the table. (The transition used was very similar to the transition described in last month's column.) At the opposite end of the table was a Gunn diode oscillator, equipped with similar horn antennas as the power meter end of the path being tested.

The power meter (destination) and the transmitter (source) were tested to each other (without a table in the path); there was little difference noted in the power meter reading as the transmitter source was raised to a higher position of alignment than each horn antenna. Originally the horn antennas were pointing at each other at similar heights. Well, you say, what does this test show? This test proves that for two antennas aimed at each other, with the transmit antenna at varied heights, there will be no change in the receive antenna signal strength. If the path changes with height you have secondary path interference.

If there was a secondary reflection path it would arrive with phase difference, in reference to the main signal path. I refer to either the addition of energy or the subtraction of energy, due to the signals being in or out of phase with each other. A simple test to set up is to place something under the antennas that would reflect energy. This test simulates the earth and possibly a body of water or structures in the path between antennas.

With the table back in place, space the antennas about a foot above the table surface (exactly the same position as the previous test, without table). Place a piece of tin foil covering the length of the table between the antennas and repeat the same test as before. The tin foil will simulate the earth, structures and bodies of water. Slowly increase or decrease the vertical position of the transmit antenna and source, while watching the power meter for any change in dB level. Note as you change vertical height there is quite a change in power meter reading. There will be a point where you can reach minimum and maximum meter indications.

This change that you now see is directly affected by the tin foil reflecting part of the microwave signal into the detector with the main path signal. This is ground reflection, or multipath, affecting the total path performance of the microwave signal. It's kind of a slick trick to see a complete antenna test range on top of a table. I find it very interesting to demonstrate in miniature the test range and see firsthand things we have read about antenna structures, but because of the lower frequencies involved, we were not able to create these types of effects. You can read about them but the demonstration brings the message home much better.

Polarization tests

Another experiment can be one test of polarization, that is, where both antennas are vertical or horizontal. Is there a penalty in the transmission and reception if one antenna is vertical and the other horizontal in polarization? This test can be made with the test range from the last experiment—just remove the tin foil from the test setup and note the power meter reading. Let's say it was reading +5 dBm for a point of reference. The number is not important: Just record what you are reading, for reference in dB power.

We're assuming that the transmitter is mounted on a small camera tripod for these

tests. Unlock the swivel mount of the camera tripod, and while noting the power meter reading, slowly rotate the mount into a vertical position. Notice the power meter as you rotate the antenna from one polarization to another. If things are proper you should see something near 30 dB, all things being equal. We saw a dB change on our test range of 26 dB, as read on the power meter. This was attributed to our test fixture and influence from reflections in the garage. For demonstration purposes it worked well.

Circular polarization

What other tests can you perform in such an antenna test range? Let's try circular polarization. This is neither vertical nor horizontal but can be described as using a spiral type of antenna when incoming signals are of various polarizations. You are familiar with crossed polarization antennas that are used for satellite communications. They differ from circular antennas in that they can be switched to either vertical or horizontal by a relay at the antenna.

As the name implies they are cross-polarized, in that two single-beam antennas are combined on one boom to support both polarizations, vertical and horizontal. Usually for gain purposes two sets of such antennas are mounted horizontally in reference to the antenna tower or mast.

The circular antenna can take several forms, one being constructed like a coil of wire as it is taken off a spool and allowed to drop to the ground in coils much like a stretched Slinky™ toy. This type of antenna is frequency-dependent on a center design frequency. It is not sharp, but rather broadbanded in nature. See **Fig. 2** for circular antenna details.

Another form of spiral, or helix, antenna can take the shape of a modified coil, or helix, in that the coils start at the feed with a very tight coil and as the length of the antenna increases so does the spiral increase. It's much like winding a spaced coil of wire on a pointy ice cream cone.

Still another version, used for condensed space, is a small flat circular spiral etched on a piece of PC board. The spiral is very tightly wound of really closely-spaced printed lines etched on the circuit board. This antenna is broadband in frequency range from several GHz to about 12 GHz. This type of antenna is primarily for radar threat reception and similar uses.

These antennas are usually found in surplus, looking much like a can of tuna with a coax connector on one side, and a plastic or epoxy lens on the front side. Some show a spiral pattern on the plastic side through the plastic cover. Other forms could be of similar diameter but only a quarter of an inch deep, with a coax connector, again, on the back side of the antenna.

In any case, replace the horn antennas on both ends of the tabletop test range with the spiral circularly polarized test antennas. Repeat the previous test as to vertical/horizontal movement of the test antenna. Note the power meter reading this time, when the test antenna is rotated between vertical and horizontal patterns. Did the meter change in level from the test rotation?

Repeat the test on multipath with the spiral feeds. Replace the tin foil on top of the table before running this test. We did not have time to finish this test at our monthly microwave meeting. Give both these tests a try. Just had to leave you with something to ponder and speculate on when the spiral is varied in height above the tabletop. I will answer that question next month.

If you want to work out a pattern of the antenna you have under test there is a simple platform to construct that will manually let you test an antenna, be it a horn spiral or other 10 GHz antenna on this test range. What you need to do to evaluate the antenna pattern is to place the transmitter with its antenna to be tested on a calibrated turntable. What you should do is to scribe 360-degree compass calibration marks on the turntable from an old record player turntable and rotate the entire antenna and turntable while taking readings.

If you're diligent enough, you can make checks every degree or so, to evaluate what the power meter sees from the test antenna, as you rotate the test structure turntable and antenna about the compass headings. The best way to do this test is to take the test antenna range out of the garage and out into the open to avoid reflections of nearby objects interfering with the transmission of energy between the two antennas.

Commercial manufacturers have automatic equipment to perform tests and create examples, but we can do similar, if less high-tech, testing. Sure, it takes time to make a lot of readings, but when you plot them out on a piece of graph paper you will have a picture of what your antenna's beam pattern looks like from this simple antenna test range.

I cannot state this more strongly: Recording many readings like this gives a true picture of just what an antenna is doing—be it at 10 GHz, or at lower frequencies where you cannot repeat the test, because

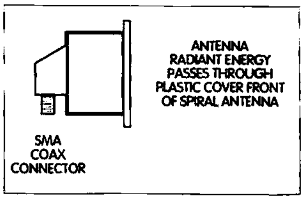


Fig. 2. Several types of circularly polarized microwave broadband antennas are similar; shown is an example of a typical military surplus model.

Number 52 on your Feedback card

THE DIGITAL PORT

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

You can still build your own packet modem, and this may be a fascinating project for your club. In past columns I have covered the ease of building a serial modem for the HF digital modes and lamented on the lack of the all-important TCM 3105 to build a VHF packet modem. Through the thoughtfulness of Dave WA4GVT, I found LDG Electronics still has a supply of ready-to-go kits to build your own low-cost 1200b packet modem.

I don't know if there will be more kits after these are gone, but there are probably enough for those who wish to take advantage of a most reasonable entry into packet radio. The price tag, at $30, should be enough incentive to grab the interest of even the most frugal prospective packeteer.

The cost will cover all you need except for connectors, cables and an enclosure. You will find instructions to build your own cables are included, so you can save a little there. And it will perform, of course, without the enclosure. There is a terminal software package included, plus there are a lot of programs available elsewhere to make this project successful and fun to experiment with.

The disk in the kit contains, along with the program, a comprehensive educational manual that explains packet operation, plus explicit instructions for assembly. The printed circuit board is plainly marked, and by following the step-by-step instruction sheet, the assembly is simple and straightforward. All in all, it's an enjoyable experience.

You will also find a parts list that gives Radio Shack™ numbers for connectors, cable parts and a suggested enclosure. I found the box was no longer available and substituted a part # 270-1802. This worked well, though it was necessary to elongate the mounting holes on the PCB slightly to fit the bosses in the box.

Also, you will want to avoid one of my forays into near futility. Since I wanted to use the same 25-pin cable to this modem as I use on the HF modem and the BayCom™, as well as the PK232, I installed a connector on the end of the box that just does *not* belong. It will survive and doesn't look really awful, but only after drilling and tapping, epoxy, plus modifying the connector. A nine-pin connector is the best advice. Of course, a plastic shoe box would offer more leeway for the untamed builder.

It works great

After completing the hardware and cabling stage, I brought up my copy of BayCom 1.4 software. It has been the most reliable of all I have tried for use with the serial modem, so I like to rule out failure at first, then advance into unknown waters later. The Basic Packet Modem is a sparkling success. It connects to the local PBBS with speed rivaling the PK232.

I found the previous source of this version of BayCom software is no longer at the Web site where I first discovered it. After running an Internet search, I could only find Version 1.5 (I've listed the address in **Table 1**). It is a DOS program and the documentation that comes in the separate "Manual.zip" will lead you through the setup and operation.

As with any terminal program, the configuration must be correct. So ... print the manual, read it and follow the instructions. It is an education in itself.

As I read and listen to others, I hear similar praises for this program. I did find Version 1.4 in other than English versions, but even those locations are getting sparse. Version 1.6 is out and not a freebie. I have not had my hands on it, but presumably the commercial version is a tad more user friendly. Take this as your clue that the freeware version takes a little getting used to.

The often mentioned freeware from George SV2AGW is listed in **Table 1**. George is continuously upgrading his programs and they work very well. I found, in this instance, that my local node was not responding as well to the commands from this software as I would have liked. You will find performance varies from node to node, so experimentation is a key here.

Incidentally, George tells me he has been working a gateway onto the Internet in Europe with an interface he wrote and surfing the World Wide Web with Netscape™ and similar browsers. There is a glaring difference between the possibilities as we see them in the States and European packet radio where they are running at 9600 baud. I hear numerous complaints that we need to upgrade from the snail-like 1200b. ... Someday.

Speaking of other software, I received a few messages from hams that made me rethink my position on PCFlexnet. Don WL7NF sent me info via packet that there is a driver on the PCFlexnet Web site that will work with the SoundBlaster™ cards. I had stated previously there was no such module. Just to be sure, I received word from Jim AB8AB that he had the system up and working with just a little tweaking left. So ... it can be done. Just leave it to the persistent ham to prove it.

A recent visit from Hal KC7STU made me painfully aware of trends in ham radio, and that some of this digital technology that we either ignore or take as a matter of course holds a large degree of the answer to breathe new life into this hobby. Hal is a software engineer and the things he saw that day obviously impressed him.

Some of this is not exactly new technology. Audio Frequency Shift Keying (AFSK) technology has been around for a few decades. Many of us ignored it, preferring the "real modes" of phone and CW. Besides, the cost of using digital modes was once prohibitive. You could scrimp and save to buy a radio that got you on the air. Why double the cost for something that tied you to a keyboard?

It has all changed

Hal could see there is something more to ham radio than a two-meter handheld and repeaters—and this was something he could afford and for which he could perhaps write some software to satisfy his needs. After

---

the scale of materials is too large. That's the beauty of using microwave as a modeling structure, to help explain what is happening and how the antenna is performing.

The tests you make and the data you obtain will be usable not just at 10 GHz, but will also be applicable to other frequencies. It's like working with a model train set on the living room carpet. While we know it's just a scaled-down version of a real train, its operation is just the same, be it 100 tons, or just a pound or two. The difference here is size, and with the antenna test range, it's still size—and scaling down to test for similar features and effects. Modeling allows you to demonstrate antenna performance on top of a table. 73

all, if someone with a limited understanding of computers (such as his friend Jack) could assemble these gadgets, make them work and have all this fun, Hal could surely have twice the thrills. And again, the cost is attractive.

Hal saw not only packet messages on the local ham PBBS, but the fact that, through the local node, there is a gateway to other packet nodes around the world. Plus, it is possible to access Internet gateways and enter another realm of communication. Additionally, he got a quick tour of what is being done with HF digital communications.

The excitement

When he saw the RTTY being decoded on the screen, he was glued to it. When I showed him the spectrum analyzer built into the HamComm software his eyes sparkled. Then, even though we picked a time when there wasn't much SSTV activity, there was just enough to make him nearly salivate. Oh, the things he could do!

The most important aspect of all this is that we have, within this digital communication framework, the means to retain the attention of the current crop of new inductees. I could detect the quickening of the senses when Hal reflected on the fact that these communications were being accomplished without relying on the telephone. This comparison relates to so much that is currently done with modems over landline.

What I am saying is simply this: If we are to hold the interest of the new ham generation, we must let them know these modes are available, affordable, and expanding. They can be part of a technology they can contribute to, plus have a lot of fun doing it.

If you are thinking of getting on board the digital trend, this will be a good project to do and share with a ham of your acquaintance. It could be a catalyst not only for your friend, but you may revive something fascinating in yourself by putting together a neat little project that provides communication through the airwaves.

Packet communication is usually done through bulletin boards, but it can be keyboard to keyboard. That is another facet that will stir your imagination when you connect to a friend across town. It is similar to AMTOR or PACTOR in that you make a link in the connection and the packets are self-correcting so the received message is identical to that which was transmitted.

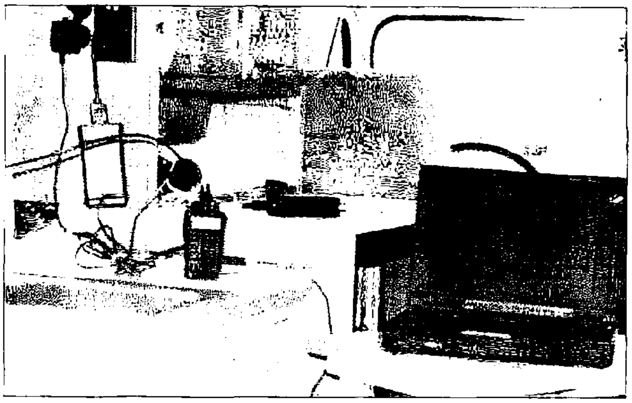


***Photo A**. Packet on wheels—Since the LDG Basic Packet Modem draws its power from the serial port of the computer, it is possible to run the entire packet station from batteries. Here, the battery providing power is the auxiliary battery of the RV. The modem is located just to the right of the ICOM W2A HT that is running without its battery attached. This makes the modem approximately the same dimensions as the radio. Two simple cable connections and your station is on the air. It was up and working at the time of the photo. The camera flash killed the screen display.*

When you want to try this keyboard stuff over long distances, RTTY is a nice step and the cost is, again, nominal, with the use of a serial modem and a piece of low cost shareware. You can talk to the world with equipment you made yourself and find many others following the same path. Check out the Web site listed in **Table 1** for HF serial modems and my column in the February 1998 edition of *73*.

With the addition of the LDG Electronics Basic Packet Modem, I now have a modem for VHF packet and, in a matching box, an HF serial modem for RTTY, AMTOR and SSTV.

Continued on page 54

Current Web Addresses	
Source for:	**Web address (URL)**
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free programs	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom – German site	http://www.baycom.de/
Pasokon SSTV programs & hardware	http://www.ultranet.com/~sstv/lite.html
Winpack shareware for Windows	http://www.duckles.demon.co.uk/ham/wp.htm
Baycom 1.5 and Manual.zip in English	http://www.cs.wvu.edu/~acm/gopher/Software/baycom/
Tucson Amateur Packet Radio—where packet started—new modes on the way	http://www.tapr.org
VHF packet serial modem kit	http://www.ldgelectronics.com

***Table 1**. All of the above were cut and pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later.*

Number 54 on your Feedback card

Ham to Ham

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Your input is always welcome!

Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. The series began in the January 1998 "Ham To Ham" Column and Part 6 of that series appeared last month. Part 7 follows:

Lightning protection—what your mother never told you, part 7

Last month, we talked about the special considerations needed for high-rise building antenna installations, but even so-called ground-mounted vertical antennas require the same type of earthing as do other antenna structures for lightning protection. If operating on 160 or 80 meters, the lightning ground should also make a great counterpoise for your quarter-wave ground-mounted vertical! Remember, a vertical's impedance is half that of a dipole's (about 35 ohms for a full-sized quarter wave). This means that the better the ground plane, the worse the VSWR match will appear to a standard 50-ohm coax cable. As a result, a vertical with a poor ground plane may actually give a better match, and as the ground plane is improved, the match will worsen. But don't be fooled. A good ground plane is critical. The better the ground plane for RF, the better the earthing for lightning as well (assuming that the RF ground plane is actually *in* the ground). You're far better off with a good low-inductance underground earthing system than with a slightly better VSWR reading. Correct any slight mismatch with an appropriate tuning unit instead. Consider running two 75-ohm coax feedlines in parallel; this can often be the best match for a ground-mounted vertical (75 divided by 2 = 37.5 ohms).

In terms of antenna supports, avoid using trees or wooden poles to support wire antennas. If one of these supports is already in place, then install two parallel vertical copper straps from the top of the support to ground. The straps will ground a VHF/UHF antenna and divide the strike currents with the coax cable. By using two straps, the inductance in such a ground run is minimized. Also, place the straps on opposite sides of the pole to reduce mutual inductance. The coax line should run down between (and well clear of) the straps.

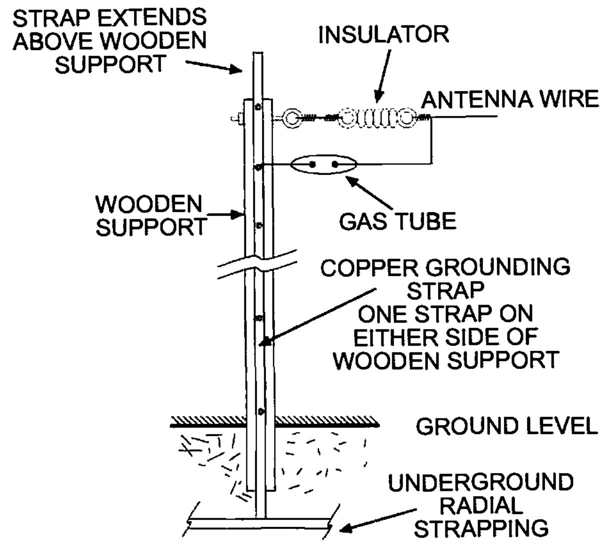


***Fig. 1.** One method of providing grounding protection for a wooden wire antenna supporting structure.*

If a longwire (fed by a transmatch) and a wooden pole (as a support for the antenna wire) are being used, the grounded straps should extend higher than the pole to intercept a strike or to divert energy to ground if the wire is struck (see **Fig. 1**). Additionally, place a high-voltage gas tube between the long wire and the ground straps or make a mechanical air gap between the wire and the ground straps. A gas tube is not adversely affected by temperature, humidity, pollution, wind or other environmental forces, while a mechanical air gap is greatly affected. It may be difficult to calculate the voltages present at the gas tube or air gap point, because they will change as bands are changed. As a rule of thumb, however, at about 7 kV an air gap would be 0.175 inch at sea level with 50% humidity. The break-over voltage goes up with higher elevation and/or increased humidity (surprisingly, humid air is actually less dense than dryer air). Gas tubes can also be connected in series for a higher turn-on voltage; however, the turn-on times are also additive. Another gas tube assembly may be added closer to the match box for additional safety.

For dipole antennas using baluns, use one gas tube across the balun (one lead of the gas tube to each of the dipole wires) and one tube from each side of the balun (where it connects to the dipole's wires) to its ground straps. This will help to protect the balun from a strike to the dipole wires and greater strike energy will be diverted to the ground before reaching the equipment.

Power/telco entrance

The story of complete protection for a ham shack covers not only strikes to the tower but also high voltages on the utility lines coming into your shack. By using single-point grounding, ham equipment will survive a hit to its tower. If the outside (tower/perimeter) ground system has a low impedance, most of the strike energy will be dispersed into the ground and little energy will enter the shack. If the ground conductivity has deteriorated over time, the ground system

The Digital Port

continued from page 53

Both of these are low-cost projects you can do yourself. Now, I need to add an HF antenna to the RV and I can play just about anywhere. Ah, the things a ham can do with his toys!

To contact LDG Electronics by phone, call (410) 586-8475. Their mail address is 1445 Parran Road, St. Leonard MD 20685. A really good look at their wares can be found on their Web site as listed in **Table 1**. Their real claim to fame is in other areas of ham radio—especially impressive is their automatic antenna tuner kit. You will be impressed when you see their full product line. 73

can only absorb a limited amount of energy before becoming saturated. In 90% of all earthbound lightning strikes, a traffic jam of electrons will be forced into the tower. If the electrons cannot disperse in a reasonable time frame, the back-up pressure (voltage) will find or create another path. The ground system, if too small in area, will cause more energy to traverse the cables and other lines into the shack. These last two sentences are very important: Please read them once more. The I/O protectors can keep the voltage levels between the single point ground and the signal line(s) at survivable limits, but the energy is only diverted elsewhere. This "elsewhere" might be onto the house telephone and power lines, leaving other appliances at risk. When the ground system is saturated, the energy can even actually come up from the (utility) ground system (and go through a television receiver for example), in an effort to leave the area by way of the cable television drop. Similar problems can also exist with satellite dish installations.

The best way to protect the rest of your house from these occurrences is to provide protection at the power and telephone service entrance(s). The utility ground rod is used by both the power neutral and the telephone protector installed by the phone company. By placing a power mains protector and a secondary telephone line protector at this location, the entire house will be protected. The cable television or outside antenna coax should be redirected, and a coaxial protector installed at this same point. The cable company-installed protector is usually just a grounding block that will earth only the outside shield of their coax; it does nothing for the center conductor energy, which can carry as much of the surge as the outside shield. Install your own protector to eliminate the problem.

That's Roger and Ron's presentation for this month. If you'd like to see the original unabridged version of this series, you can contact PolyPhaser Corporation, Customer Service Department, 2225 Park Place, P.O. Box 9000, Minden NV 89423-9000 and ask for their Special Bulletin, "Protection to Keep You Communicating" (©1995). You can also pay a visit to PolyPhaser's home pages on the World Wide Web at: [http://www.polyphaser.com/]. PolyPhaser's Web site also supports text downloads of the original material that's going to be condensed here, plus other related texts on the subject. The PolyPhaser Tech Line telephone BBS at (702) 782-6728 is also available to interested readers. The communications parameters are: Data bits—8, Parity—None, Stop bits—1, Baud rate—300 to 14400. If you are dialing in for the first time, the Tech Line requests your name, address and telephone number. You will also need to create a password. Once you've logged on, just follow the menus to navigate around the Bulletin Board. The "Ham To Ham" column will continue this series on protecting your ham station from the destructive effects of a lightning strike, with part 8 coming up next month.

Follow the pattern!

Here are some interesting notes from Dick Warren W7TIO, regarding the addition of radials to a half-wave amateur VHF (or UHF) transmitting/receiving antenna as described in "Ham To Ham," November 1997. In that column, M. Marcel Chapleau VE2GMZ of Quebec, Canada, described a VHF/UHF J-pole antenna to which he added two-meter and 70-cm radials to achieve better results. In the moderator's notes, I commented that the use of radials wasn't normally called for with half-wave antenna designs, since a half-wave antenna is a complete minimum antenna unto itself (no phantom ground plane was needed). In the following text, however, Dick brings up some interesting points gleaned from his years of experience in the commercial two-way radio installation and maintenance field ... points well worth remembering.

From Dick Warren W7TIO: "Over the years, I've worked on many commercial 'base station' installations, and while many hams feel that a half-wave vertical doesn't need a set of radials because it's a 'complete' antenna in itself, it is commercial practice to put ground radials on every vertical collinear gain antenna installation (of those not made up of folded dipoles as explained more fully below).

"Most hams know that the horizontal ground radials under a quarter-wave vertical are needed to provide a 'mirror' or 'image' antenna, thus making a 'complete' half-wave radiator, as well as to support the driven element itself. The down side is that these horizontal radials also put the radiation angle way above 45 degrees (referenced to the horizon). An antenna used for HF skip work may benefit from this high angle of radiation, but at VHF/UHF frequencies, it wastes a goodly part of the RF into the atmosphere, by not putting it at the horizon where it's needed. Drooping radials, however, provide the same 'image' antenna, and also lower the radiation angle nearer to 45 degrees. The drooping radials will raise the 50-ohm feedpoint impedance to nearer the 72-ohm expected half-wave feed impedance.

"Sometimes you'll see a repeater/base station antenna mounted upside down, on a very high point such as a mountain top. Mounting it upside down inverts the high angle of radiation and puts the energy down into the desired coverage area in the valley below.

"In the case of the ever-popular five-eighths-wave vertical, the five-eighths-long radiator brings the energy back down nearer the horizon, and additionally narrows the beamwidth. This concentrates the signal and produces the typical gain figures attributed to five-eighths-wave radiators. The coil provides impedance matching to the 52 ohm feedpoint, by presenting a simulated three-quarter-wave feed, and does not affect the radiation angle. This antenna still needs ground radials, however, and is used in some commercial 450 MHz limited-range installations.

"Other commercial installations use vertically-stacked, vertically-polarized 'folded dipole' type antennas ... and these configurations need no radials. However, those commercial antennas that look like a stretched-out ground plane, some 20 feet long at 150 MHz and perhaps six feet long at 450 MHz, do have radials, under what is a multi-half-wave collinear gain antenna ... ground radials are always put under this variety. An antenna of this type can produce omnidirectional gains of 10 dB, almost like having a 10-element beam in all directions!

"The next time that you pass a professional communications installation, be it a commercial or governmental facility, stop and study some of the antenna design options used in this service. See if you can pinpoint the designs I've referred to here; it's likely that you'll see these techniques put into practice. They work well, since these installations are engineered for the coverage needed as well as for dependability. People's lives often depend upon them!"

Go figure!

From Doug McKibben KB9IMG: Here's a tip for determining how to easily and quickly get the sloping elements of an HF inverted vee antenna at a true 45-degree angle for optimum performance. "It's been known for years that the optimum angle for the elements of an inverted vee should be 45 degrees from vertical, but most antenna books don't explain

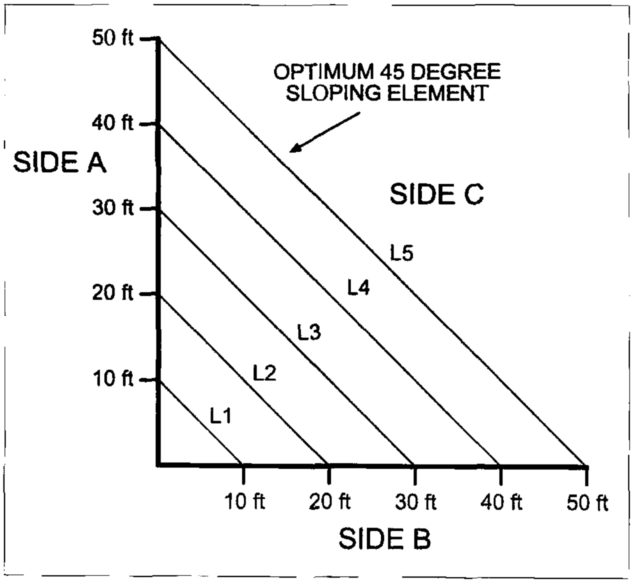


Fig. 2. Relative lengths of the 45-degree sloping elements of an HF inverted vee antenna for various mast heights and at various distances from the mast's base. See text for details on how to determine length of Side C.

how you can easily determine when you've achieved that 45-degree angle. The answer can be found by using basic geometry, but in case you've forgotten (or would rather forget) that high school experience, I've laid out the basics here, limiting the explanation to only what's needed for the job at hand.

"Since most of us find ourselves limited to fairly low mast heights (because of landlord or neighborhood constraints), I'll start with an example of a 30-foot mast for a 40-meter inverted vee. Looking at **Fig. 2**, the vertical mast is depicted as Side A of the right triangle that will represent one half of our 40-meter inverted vee. Side B of **Fig. 2** is the straight-line distance from the mast to the first ground anchor for one of the antenna's elements. Use Pythagoras' theory: $A^2 + B^2 = C^2$.

"So to find out what the total value (element length plus extension rope) of Side C will be, simply add the square of 30 (900) plus the square of 30 (900) which gives us 1800. On your calculator, enter 1800 and press the square root button. The answer is 42.43 feet. Since one element of our 40-meter antenna is 33 feet, nine and a half feet is left over to reach the ground stake, so the rope extension and egg insulator will be nine and a half feet long (plus whatever you feel you'll need to make the knots at each end of the rope. Remember, this is only half of the inverted vee; the other side will be identical with the feedpoint at the top of the mast.

"If you can only manage 25 feet of mast height, the value of Side C of the right triangle in **Fig. 2** comes out to be 35.35 feet. This puts the sloping wire end of a 40-meter inverted vee (again, 33 feet) only a couple of feet above the ground, but the antenna will still work well.

"Now try calculating what the length of Side C would be for a 15-meter inverted vee with a mast of 20 feet high yourself. Don't peek! You should have calculated 20 squared (400) plus 20 squared (400). The square root of 800 is 28.28 (feet) and a single element at 15 meters is about 11 feet, so the amount left over for the egg insulator and rope would be about 17-1/2 feet.

"While you have this method well in mind, why not come up with a chart showing the element lengths and insulator-rope extensions for all of your favorite bands or band segments? Just to complete **Fig. 2** for you, however, the various overall lengths of Side C for the 10, 20, 30, 40 and 50 foot marks from the base are:

Side C

L1 = 14.14 feet

L2 = 28.28 feet

L3 = 42.43 feet

L4 = 56.57 feet

L5 = 70.71 feet

"Just keep in mind that in order to have a true right triangle, with a 45-degree slope on Side C, the lengths of Side A and Side B must be equal. Then, squaring Side A and Side B, adding them together, and taking the square root of that total, will give you the length of Side C, which is the antenna element's wire plus any needed insulating extension. The length of the actual wire element is given by the antenna book formula: 468/Frequency in MHz (divided by two for just one of the elements)."

Moderator's note: You can use Doug McKibben's right triangle hint to find the exact 45-degree angle for the radials mentioned by Dick Warren in the piece above here as well. Simply reverse the formula, squaring the length of the VHF antenna's radial, dividing by two, taking the square root of that figure, and measuring out from the antenna's mast by that amount. The drooping radial should end up at that point for a 45-degree angle.

Murphy's Corollary: Once you open a can of worms, the only way to get them back in is by using a much bigger can!

Many thanks, as always, to our loyal contributors. Remember, I'm always looking for interesting and innovative tips, ideas, suggestions and shortcuts to include on the pages of *73 Magazine* within this column. Just jot down your thoughts and send them to the address at the beginning of the column. Those who accepted the offer this month are:

O. Dick Warren W7TIO
Certified Electronics Technician
P.O. Box 973
Pleasant Grove UT 84062-0973

Douglas R. McKibben KB9IMG
2112 Marion Avenue
Mattoon IL 61938

If you're missing any past columns, you can probably find them at *73's* "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to *73 Magazine's* "Ham To Ham" column, c/o Dave Miller NZ9E, 7462 Lawler Avenue, Niles IL 60714-3108, USA. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions on any particular tip to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

NASA resources

Those of you who follow my column know that I always incorporate a unit on space travel and communications in my ham radio classes. For the past 20 years I've been teaching "Introduction to Amateur Radio" to 6th, 7th, and 8th graders at Intermediate School 72 in Staten Island, New York. Through the years, the teaching techniques and motivational devices have had to change due to the constant changes in population in a culturally diverse school.

The area of instruction that continues to spark the children's imaginations and stimulate them is the unit about astronauts, space shuttles, and radio communications. Many of the great lesson ideas come from the NASA resource guides. The *Educational Horizons* newsletter, which was a tremendous source of information, has been discontinued due to budget constraints. I have, however, put together a list of other NASA resources that will be valuable for teachers to make use of in the classroom.

Educators can utilize Spacelink, which provides electronic access to NASA educational materials, news, and reference data as well as educational products, images, and computer software that can be useful to educators, students, and the general public. Spacelink also provides a powerful search feature and links to other NASA educational sites throughout the Internet.

NASA Quest is an electronic resource specializing in providing programs, materials, and opportunities for educators and students to use NASA resources as learning tools to explore the Internet.

NASA Television (NTV) is the agency's distribution system for live and taped programs. It offers educators and students a front-row seat for launches and missions, as well as informative and educational programming, historical documentaries, and updates on the latest developments in NASA research.

NASA On-Line Resources for Educators provides current educational information and instructional resource materials to teachers, faculty, and students. A wide range of information is available, including science, mathematics, engineering, and technology education lesson plans, historical information related to the aeronautics and space program, current status reports on NASA projects, news releases, information on NASA educational programs, and useful software and graphic files. Educators and students can also use NASA resources as learning tolls to explore the Internet, access information about educational grants, interact with other schools that are already on line, participate in on-line interactive projects, and communicate with NASA scientists, engineers, and other team members to experience the excitement of real NASA projects. The address is: [http://www.hq.nasa.gov/education].

NASA Spacelink is one of NASA's electronic resources specifically developed for use by the educational community. This comprehensive electronic library contains current and historical information related to NASA's aeronautics and space research. Teachers, faculty, and students will find that Spacelink offers not only information about NASA programs and projects, but also teacher guides with activities, images, and computer software that can enhance classroom instruction. Spacelink also provides links to other NASA resources on the Internet. Educators can access materials chosen specifically for their educational value and relevance, including science, mathematics, engineering, and technology education lesson plans,

***Photo A.** There are many projects and ideas you can get from NASA resources.*

Radio Bookshop

Phone 800-274-7373 or 603-924-0058. FAX 603-924-8613. or see order form on page 88 for ordering information.

see order form on page 88

Wayne's Five Buck Books:

98 Books You're Crazy if You Don't Read. Brief reviews of books that will help make you healthy, wealthy, and wise. If you are sick you did it to yourself through messing up your body. This is probably the single most important five bucks you'll ever spend.

How to Make Money. A Beginner's Guide. Commuting to work is stupid. You can't get fired, laid off, downsized or outsourced if you own your own business. This is an instruction book on how to get others to pay you to learn what you need to know to be independently wealthy, have a ball doing it, and have that ham shack you've dreamed of.

Grist I. Fifty of Wayne's recent non-ham oriented editorials. They're about almost anything and guaranteed to almost make you think. You'll sure have things to talk about on the air other than your antenna and the weather.

Grist II. Fifty more non-ham editorials. Even more fascinating stuff to think and talk about.

information on NASA educational programs and services, current status reports on agency projects and events, news releases, and television broadcast schedules for NASA Television. Spacelink may be accessed at the following address: [http://spacelink.nasa. gov]. For additional information, E-mail a message to: [comments@spacelink. msfc.nasa.gov].

Quest is the home of NASA's K-12 Internet Initiative, one of the electronic resources that the agency has developed for the educational community. The project specializes in providing programs, materials, and opportunities for teachers and students to use NASA resources as learning tools to explore the Internet along with some of their projects designed for this specific purpose.

One of Quest's most unique endeavors is the "Sharing NASA" on-line interactive project. Students and educators are given the opportunity to communicate with NASA scientists and researchers to experience the excitement of real science in real time. In addition to these programs, the project also houses information about materials that accompany the K-12 Internet Initiative videos. These videos promote the Internet in school and assist educators in acquiring and integrating the Internet into the classroom. For information about the videotapes, send an E-mail message to: [video-info@quest.arc.nasa.gov].

NASA Television (NTV) features space shuttle mission coverage, live special events, interactive education video conferences, electronic field trips, aviation and space news, and historical NASA footage. Programming has a three-hour block—Video (News) File, NASA Gallery, and Education File—beginning at noon Eastern and repeated, with the last block beginning at midnight Eastern.

The Education File features programming for teachers and students on science, mathematics, and technology. You and your class can investigate exciting NASA research endeavors in aeronautics, microgravity, planetary sciences, human exploration of space, Earth systems, robotics, and more. Educators are welcome to videotape from NTV. Check the Internet for program listings at: [http://spacelink.nasa.gov/NASA.News/]. Check the NTV Home Page, select "Today at NASA," "What's New on NASA TV?" and "TV Schedules."

I know you will find these online resources to be informative and helpful. Combining these interactive lessons with ham radio curriculum can only add a whole new excitement and stimulation to your classroom. Have fun and write to me about your experiences with the NASA resources.

Number 58 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

If you build most of your equipment, then there's a good chance that you're a QRP operator. As a group, we sure seem to go through a lot of solder in the course of a year.

This month we'll look at some tools of the trade to make building our gear faster and easier. Now, it may seem a no-brainer to most of us that you must use hand tools to assemble electronic projects. How many of us have a soldering iron, screwdrivers and a hammer or two? But, to really make your life easier, there are some tools you've just got to have in your toolbox.

The basics

I'll start with one of the most basic tools used by all QRP operators—the soldering iron. If you only have one soldering iron, you're really missing some labor-saving tools. A well-equipped QRP workbench should have at least three different types of soldering equipment. You'll need one soldering iron for soldering parts on PC boards. This soldering iron should be between 15 and 25 watts. A 25-watt iron is really pushing your luck if you are planning on using that much heat on a PC board! Of course, you'll also need a small 1/8-inch conical tip to prevent solder bridges on the PC board.

With a 15-watt iron, you'll have a time removing a part from a double-sided PC board with desoldering wick. So, you need more oomph to remove parts from a PC board. I recommend at least a 35-watt iron with a wide spade tip. An iron that generates 35+ watts must be used carefully when desoldering PC boards. Too much heat and you'll lift traces off the board.

The third soldering iron you'll need is a whopping 50-watter. This guy is a must for soldering PL-259 connectors or large terminal strips to PC boards. It works great for just about any antenna project, too. I use an American Beauty 60-watter for just such chores. Although you don't come across them too often in this day and age, if you work on old boat anchors, a high-wattage soldering iron is a must.

Plan on keeping at least three different wattage soldering irons on your workbench. Not only will they reduce your work load, but they will make your life easier, too. Trying to solder a PL-259 with a small-wattage soldering iron will more than likely damage the coax before the solder melts.

Also, keep a good selection of soldering iron tips on hand. This is one case in which one size does *not* fit all. Change the tips to match the job being done. Don't wait until the tip is trashed to replace it. Get iron-plated tips: they'll last much longer than the plain old copper ones will.

Keep your soldering iron tips in good shape with a damp sponge. Most newer soldering iron stations have a sponge built-in. When the sponge becomes damaged, replace it with a new one.

Several companies also market special chemical pads to help re-wet the tips. If you do a lot of soldering, these are a good investment.

Screwdrivers and nutdrivers

I'm frequently surprised at how many hams lack a good set of common screwdrivers on the workbench. Since we are working with small parts, we need small screwdrivers.

Radio Shack™ sells a compact set of jewelers' screwdrivers for under $11. Sears™ also carries a set of precision drivers for delicate work. I prefer the Wiha™ precision screwdrivers myself. They're available from FAI Electronics™. It's not a bad idea to have a set of precision slotted, cross point and Torx® screwdrivers.

You should also have a set of standard-size (for working on the lawn mower) screwdrivers as well. Check the ones that you are using. Are the tips in good condition? If not, they can be ground back to their proper size and shape with a power grinder. Most of the time, screwdrivers are used for just about everything—except for driving screws. Making sure the screwdrivers are in excellent condition will make your job easier.

A set of nutdrivers should also be included in your toolbox. I prefer hollow shaft drivers. The hollow shafts allow you to tighten the nuts on volume controls by allowing the shaft to fit inside the nutdriver. Check before you buy, as some hollow nutdrivers won't fit over the 1/4-inch shafts. If you've ever scratched the front panel of your latest creation, you'll see that a set of nutdrivers is worth its weight in gold.

The next item I myself had done without, only to have things bite me in the butt time and time again. Late last year, I sprang for the money and purchased a set of alignment tools.

There are so many different types of coils and slug tuned inductors in today's rigs, you really need a selection of alignment tools. This is another case where one does not fit all. If you use the wrong size tool, you'll crack the slug in a form. Try using an alignment tool that's too small for the slot in an inductor, and you'll chip the top right off. Of course, the odds of this occurring on a Saturday night are unbelievably low!

I have several "kits" from various companies. I know that somewhere in those kits, I'll find the proper alignment tool. Hosfelt™, FAI™ and Mouser™ all sell alignment tools in kits or by the piece.

As with anything, you get what you pay for. If you pay for cheap alignment tools, you'll get cheap tools. To avoid breaking coil slugs, then you must have the right alignment tools.

Wire cutters and nippers

Stuffing a PC board with resistors, diodes, and other through-hole parts is the most popular activity with homebrewers. Have you ever taken a second to check the wire cutters you've been using to trim resistor leads? I'll bet the farm that you're using wire cutters designed to cut *wire*, not component leads. There are zillions of different types of wire cutters on the market. We have the shear cutter, flush cutter, and diagonal cutters to name some of the more popular types. If you have ever looked though the pages of a Jensen Tools™ catalog you know what I mean. Prices range from about two dollars to over 90 bucks a pop!

In my shack, I use several types of cutters. All of them are under five bucks, and for me they're disposable. When first purchased, they're really sharp, and I use them for cutting resistor leads, diode leads, and other pieces parts on PC boards. After they start to get a little dull, they're used for cutting wire and nipping off larger component leads such as AMP pin terminals. When they're all nicked up, the last place you'll find them on my bench is for cutting thick wire (12 gauge), terminal blocks, and small bolts. When the cutter is completely worn out, it's on its way to the recycling center.

I have three favorite cutters. The first one is an easy-to-obtain cutter from Radio Shack. Called the "Nippy Cutter," this guy goes for about $4. The cutting edge is very sharp, but I've found the ends are rather brittle. They'll break if you try to cut too much at one time.

The next two I get from Hosfelt Electronics, Inc. Their number 170M is a micro series shear cutter. It's about $5, and has a very nice cushioned hand grip.

The other cutter from Hosfelt is the model 175M. This guy is $6 and has an internal safety clip. This safety clip helps hold the lead as it is being cut, preventing the lead from flying into your eyes.

The key to the above cutters is knowing when to toss them out. Although in the long run it may be cheaper to get some of the very expensive cutters, I find the disposable route is the best for me. I assemble a lot of PC boards here because of SunLight Energy Systems. I go through about four pairs of cutters per month. On the other hand, I assemble hundreds and hundreds of PC boards per month as well.

PC board holders

Speaking of PC boards, unless you put one kit together per year, you really should have a PC board holder of some kind.

Here in my shack, I use four different types. For working with one PC board at a time, the best thing going is the Panavise circuit board holder #315. Of course you'll also need at least one of the Panavise base mounts to hold the circuit board holder. Both the Panavise mount and

Continued on page 60

Homing In

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/
homingin/]

Receiver hunting

Whenever I make a presentation on hidden transmitter hunting to a radio club or convention, one of my main points is that radio direction finding (RDF) skills have many other uses besides radio sports. There will surely be occasions in your life as a ham when these techniques can help you, even if you never go on a hidden transmitter hunt or track down a malicious interferer.

Is that loud buzz on 10 meters coming from a power pole on your block? Where is the cable TV system leak that wipes out the 145.25 MHz repeater? Which of the dozens of radio sites in your city is the source of the intermodulation product hanging up your repeater? Radio direction finding can help answer all these questions.

RDF could even save you some money, as it did for Rick Choy N3HXT of Winchester, Virginia. Rick hones his RDF skills as a trustee of the Shenandoah Valley Amateur Radio Club, where he and others keep the repeater free of jammers and stuck mikes. "We are usually successful at tracking and finding a fox in around an hour within a 15-mile radius," Rick writes. "We use yagis, loops, TDOAs, Doppler units, and highly sensitive field-strength meters. Many of the circuits came from the book *Transmitter Hunting—Radio Direction Finding Simplified*." (It's available from *73*'s Radio Bookshop.)

When Rick lost his pager recently, it led him on a different kind of RDF effort. Instead of a transmitter hunt, he went on a receiver hunt. But before I tell the story, did you know that most receivers are also mini-transmitters?

Receivers transmit, too

As you may remember from your ham license studies, all superheterodyne receivers include at least one RF oscillator. For instance, when you tune a typical FM broadcast set from one band edge to the other, you are adjusting the frequency of its local oscillator (LO) stage from 98.7 to 118.7 MHz. This oscillator and its associated mixer stage convert the desired 88–108 MHz signal to the 10.7 MHz intermediate frequency (IF) by subtraction. The remainder of the radio's circuits amplify, limit, detect, and process the 10.7 MHz stereo signal.

Few receiver cases provide perfect shielding, so the LO signal doesn't stay confined. The FCC insists that its radiation be kept within limits, because signals in the 118 MHz range could interfere with aircraft communications. Your FM broadcast sets, scanners, and other receivers have a notice, either on the set itself or in the instructions, stating that they comply with Part 15 regulations. For VHF sets, this means that LO signals must be below 150 microvolts/meter field strength, as measured three meters away. That is far above the level of a squelch-breaking signal at that distance.

Most receivers radiate much less than that, of course, but the LO is usually detectable. For instance, when I set my scanner next to my two-meter handie-talkie, its LO puts a rhythmic ticking sound in the HT's audio. No wonder flight attendants insist that you turn off your Walkman™ during takeoff and landing.

Now back to the tale of Rick's pager, which receives on 158.7 MHz.

"I wear it on my belt, but sometimes it has a tendency to fly off when snagged by something," N3HXT continues. "Usually the clip snaps loud enough that I am alerted to what has happened. Once, while walking through the woods, a small branch grabbed it and when I turned around, it was hanging eight feet in the air!

"One day, I was down at my pond clearing some shrubs, scrub growth, and small trees. I also worked in the garden, cutting and burning some of last year's planting, and I used a backhoe to move a few large piles of dirt around. I covered quite a bit of territory on my 12-acre tract that day.

"When I got back to the house, I noticed that the pager wasn't on my belt. It took me some time to figure out that I didn't just take it off or leave it in my car. I knew I had lost it somewhere outside and I didn't have much time to find it because of threatening rain that would ruin it. What worried me more was that I could have buried it by accident in one of my dirt piles.

"I live in a rural area in a fringe of the pager's range. Sometimes it works and sometimes not. I tried dialing the number from my cellular phone while walking the property in hopes that I might hear it, but to no avail. I worried that I could have left it in silent 'vibrate' mode and would thus never hear it.

"About three years ago, I did a demonstration of my Avcom spectrum analyzer at a club meeting. Using a length of RG-58 with about a half inch of center lead sticking out, I could sniff out a 'bug' or other weak

QRP

continued from page 59

circuit board holder are available from Hosfelt Electronics.

I also use the Weller # ESF120 circuit board holder. This guy will allow you to rotate the board around its axis. There's also a movable arm that's used to hold a part on the board while it's being soldered. This holder is great for troubleshooting a PC board. The Weller holder is $63 and it's available from FAI Electronics.

The third PC board holder I used won't find its way to your shack. This holder is designed to hold several dozen PC boards at a time. Depending on the size of the PC board, I've been able to stuff 36 boards at a pop. Here's how it works.

The boards are held in tracks. These tracks are adjustable and are easily moved up and down. Each track has a groove cut into it so a PC board will slide in. By adjusting the tracks, you can place as many boards as you can fit on the frame.

Then the fun begins! You stuff a single part into each board. You repeat this step until the entire rack is full of stuffed boards. A foam-lined cover is snapped over the stuffed boards. The foam holds the parts down onto the boards. You then flip the entire rack over and solder the exposed leads.

Finish up by trimming back the leads and the boards are ready for testing and calibration. I purchased this PC rack from a company specializing in PC board assembly. The rack is about $400 with two extra tracks.

Sources used in this month's column:

FAI Electronics
(800) 655-0006
41 Main Street
Bolton MA 01740

Hosfelt Electronics
(800) 524-6464
2700 Sunset Blvd.
Steubenville OH 43952

signal without masking by a lot of other ambient signals. I demonstrated that my pager had LO radiation strong enough to be sensed by the analyzer when I held the sensing lead against the pager, enough to put a blip on the screen 20 dB above the noise floor.

"From that, I knew that the LO frequency of the pager was 20 MHz below the receive frequency, making it 136.7 MHz. I took my Alinco DJ580 and tuned it there. I guessed that a quarter-wavelength whip antenna would give me the least loss, so I used it instead of the 'rubber ducky.'

"Most pagers have a 'sleep' mode to conserve battery power. They wake up once a second to see if a carrier is present and if the header information is valid. If not, the pager sleeps again. So I had only one short pulse per second to sense. How close did I need to get in order to hear it? Using a borrowed pager with another phone number, I determined that I could detect a distinctive carrier blip within 15 feet.

"I went throughout my house, car, and workplace with the Alinco, just to make sure I didn't leave the pager under a pile of books or under a sofa. No luck! I went around my property to see if it might have just fallen off. Still nothing.

"To see if I could detect it under soil, I put the other pager in a plastic bag and buried it about six inches. It was still detectable, but somewhat weaker. Soil density, moisture, and depth affected the amount of signal that would pass through. So if it were buried in the soil, I would have to get a whole lot closer.

"I went back to my shop and got a four-foot aluminum rod and taped it to a broomstick. I ran a piece of coax from my HT to the rod. Back to the pond I went with this contraption and a shovel. I started prodding the dirt piles with the rod. 'Blip! Blip! Blip!' A little careful digging and I uncovered my pager!"

If you think you might need to go on a pager hunt some day, Rick has some advice for planning ahead. "Find your LO frequency, write it down, and put it in a safe place," he recommends. "See if you can pick it up on your scanner or HT. Practice by having someone hide it around the house for you to look for. It's a neat way to get family members interested in transmitter hunting."

As for the hunt procedure, N3HXT suggests, "Once you get a strong signal with the telescoping antenna extended, retract it some and zero in on the pager. Soon you should be able to remove the antenna and sniff with just the BNC connector as a feedhorn. Remember, if your receiver has a 'sleep' feature, deactivate it. It may awaken the receiver when the pager is asleep, and vice versa. If so, you may never hear it."

Rick was lucky that his pager's LO was within the tuning range of his handie-talkie. More and more pager systems are using UHF. For instance, my pager (**Photo A**) receives near 930 MHz.

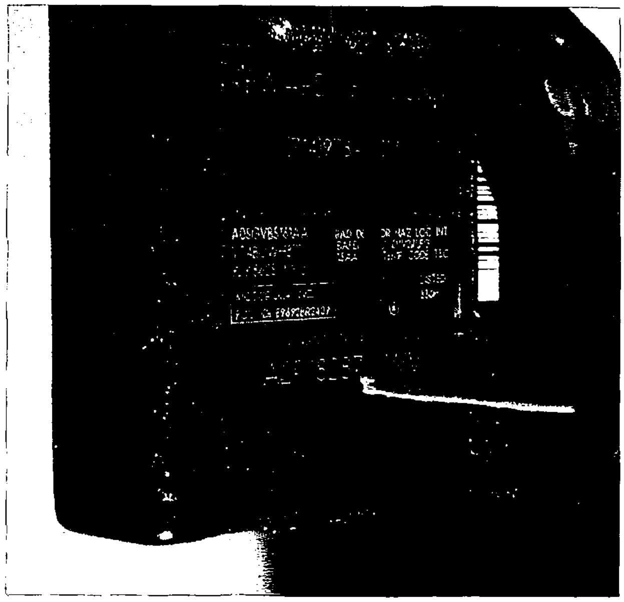


Photo A. *The label on this pager gives the receive frequency and FCC identification number, showing that it complies with Part 15 of the regulations.*

Your car's radio tells all

As in the case of N3HXT's pager, knowledge of the IF and LO frequencies is enough to determine the receive frequency. A company is using this fact to provide an important service to broadcast stations by placing sensitive roadside receivers throughout the market to be surveyed. They detect emissions from the LOs of passing car radios. The LO frequencies, and thus the receiver frequencies, are rapidly determined using digital signal processing and compiled. In just a few minutes, listenership data can be obtained from hundreds or thousands of vehicles.

Besides being unobtrusive, this technique of listener research has many advantages over traditional methods such as telephone surveys and handwritten diaries. It doesn't rely on memory. ("Let's see, what station did I punch up at 7 a.m. today?") It is so fast that it can determine radio ratings on a minute-to-minute basis, revealing which program elements and commercials are being heard and which are tuned out. I can envision someday having this data displayed in real time at the subscribing stations. (Program director to DJ: "Don't play that Waylon Jennings song any more, it made us lose 35% of our audience.")

An invasion of listener privacy? Of course not, because no attempt is made to link specific listeners with stations, as in "Red-haired Buick drivers prefer K-BLAH." And stations will no longer feel compelled to prompt the holders of Arbitron™ diaries. I will be very happy if it means that I never again have to hear an unctuous announcer say something like, "If anyone asks, remember that you listened to the Frank Flapjaw Show today."

US takes on the world

Last month I invited international-style foxhunting enthusiasts in the US and Canada to consider attending the 1998 ARDF World Championships in Hungary during the first week of September. The best radio-orienteers of over 20 nations are expected at this gathering, which will be in Nyiregyhaza, 150 miles east of Budapest.

Contrary to my understanding last month, no independent individual competitors are allowed at World Championships. Each entrant must be part of a national team. The good news this month is that our national team is forming and its application for places at the starting line has been sent to the organizers.

At present, Team USA has three members. International Amateur Radio Union (IARU) rules permit each country to have a maximum of three competitors, in each of five age and gender divisions, for the 80-meter and the two-meter event. These categories are: Women, for females with any date of birth (DOB); Seniors, males with any DOB; Juniors, males with DOB after 1/1/79; Old-Timers, males with DOB before 1/1/58; and Veterans, males with DOB before 1/1/43.

This means that plenty of positions are still available. Because the sport is so new in this

Number 62 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[pangen@compuserve.com]

OOPS!—over ...

As a people, Americans tend to be doers. In most cases we prefer to take action—even when taking action may not be the most appropriate course. To what am I specifically referring? That ever-present and tempting push-to-talk button on the microphone. We have learned to avoid salt, cholesterol, excessive alcohol and extramarital affairs. Unfortunately for some, it is still impossible to avoid the temptation to grab the mike and press that button even when we have absolutely nothing to say. It would seem that we view the PTT as an exercise machine to develop a firm and tenacious grip. Perhaps we need to press that button because, like Mount Everest, "it is there."

It's easy to see examples of this on the local two-meter repeater where the duty cycle of the transmitter seems to approach 110%. I expect to see a headline in the supermarket tabloids that scientists have determined that the absolutely smallest unit of temporal measurement is the delay between one ham finishing a transmission and the next ham keying his microphone. This may eventually be measured as a pico-micro-milli-nanosecond, or faster.

Of course, it's not only the interval between transmissions that is a problem, but the duration of the transmissions. Once many of us begin a transmission, we take serious pleasure in transmitting. After all, this is what makes us hams—the ability to transmit, and we may enjoy it so much that we may be reluctant to share the frequency with others. When on the UHF or VHF bands, most repeaters incorporate a timer to limit transmissions, yet we all have overstayed our welcome and timed out the repeater. A friend of mine took it one step further. He installed a toggle switch in his two-meter mobile rig and suspended a microphone from his sun visor. In this way he no longer needed to keep the PTT pressed. The rest of us were treated to his running commentary on his driving experience followed by those witty repeater timeout messages. When he unkeyed and heard the timer reset, he'd immediately hit the switch again and repeat whichever parts of the soliloquy he thought we might have missed.

As we all know, these practices are impolite, and might even be dangerous. During the time when most folks are driving to or from work the repeater may be so completely tied up that someone needing to make an emergency call cannot access the repeater. During disaster operations it may even be worse.

Now, what, you may ask, caused me to drag out my soap box and begin to lecture on this subject? In the April 13, 1998, issue of *Navy Times* I read an article about efforts to convert the communications with the Soviet *Mir* space station to E-mail. Why take *Mir* (and maybe the shuttle or the new International Space Station) off the ham bands? Because we hams are not being seen in the best of lights. As you may be aware, the ham stations in space are used frequently to communicate with students at their schools. The idea is to generate interest among students in the sciences, and maybe even an interest in amateur radio. Unfortunately, as the article points out, while the astronauts or cosmonauts are trying to maintain a contact with a particular school, many hams jump on the frequency and interfere with the contact. This is met with the same reaction that we have toward malicious interference or jammers. Normally I love to read about amateur radio in the paper, but not when we are portrayed as discourteous (to say the least), or when our bad habits are paraded for all to see. Some of us are old enough to remember Walt Kelly's *Pogo* comic strip wherein the expression "We have met the enemy and he is us" was coined.

The Amateur Radio Service is just that—a service. We have an obligation to serve the general public, whether it is technical education of high school students through communications with space stations or an alternate source of communications when the phone lines are down. During an emergency, disaster or public service communications, it is critical to limit transmissions to those pieces of information which must be passed along. Net control or the liaison to the command center have their hands full handling critical and relevant traffic. They do not need extraneous transmissions. There are other considerations, as well. Until we develop new technology, a given frequency will only be able to be used by one station at a time. When operating under emergency conditions, needless transmissions drain the batteries in your handie-talkie, not to mention the repeater, if it is using backup power.

In any case, here is a message that could help us get on track. Maybe we should remember what our Elmers taught us when we were younger and more idealistic and working toward our ham licenses. These good practices are important during routine hobby operations but are absolutely critical during emergency or disaster efforts.

• Listen first. Make certain the frequency is clear, or the person operating would wish to speak to you. If it is a directed net, the only person to speak with is net control, unless you get permission to go direct with another station. A ham does not interrupt a conversation in progress on the air any more than he would one in person. If your two best friends are talking, naturally, you'd join in, but it would be rare to interrupt two strangers without a compelling reason.

• Think about what you want to say before starting to transmit. Politics, sex, religion and fair weather reports during a SkyWarn session are best avoided.

• Before pressing the PTT, pause so someone who needs to break in can do so. This is especially important during rush hour when many accidents or traffic hazards can create significant problems.

---

hemisphere, you will not have to win a qualifying match to earn a place on the American team. However, you should be in good health and have some experience in the sport. You should also be prepared to fund your own travel and other expenses for the trip. Even though Team USA members will complete under the ARRL banner (because ARRL is the US's national IARU society), no League or commercial financial support has been promised as of this writing.

Team makeup and financial conditions may have changed by the time this gets into print, so check the "Homing In" Web site for the latest information. Contact me by electronic or postal mail if you are interested in going to Hungary and/or holding ARDF events in your own area. The URL and mail addresses are at the beginning at this month's column, as usual. 73

Number 63 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

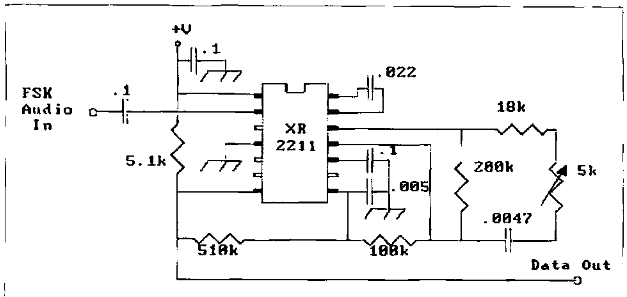


Fig. 1. XR-2211 RTTY demodulator.

A tradition has arisen with this column. It is July, and it is another anniversary. This month begins the 22nd year of "RTTY Loop." Twenty-two years—can you believe it? When this column started, my son was not yet born; now he is battling his way through higher education. When this column was starting, a popular question concerned some of the basics of radio- teletype, like which tube circuit to use as a demodulator. And now?

Michele Del Pup I3MDU, is looking for a simple but effective demodulator circuit for demodulating radioteletype.

While demodulating a radioteletype signal has a striking resemblance to computer modem tones, using a conventional computer modem just does not work for most functions, as some others of you have asked. One circuit that has remained popular is a simple one based on the XR-2211 phase-locked loop demodulator. At one time, this chip was available in every small Radio Shack™ store. Now, you may have better luck in some of the parts purveyors that advertise within the pages of *73 Magazine*.

All other components in this project are common parts, which can be purchased at Radio Shack or other parts houses. I recommend building it on a small piece of perfboard, with point-to-point wiring. Clubs may wish to etch a circuit board; this could be a useful introductory project.

Now, to the matter at hand. **Fig. 1** is a schematic diagram of the demodulator. The audio output of your receiver, either HF or VHF, is coupled to the demodulator through a 0.1 µF capacitor to pin 2 of the XR-2211. With no input filtering on this device, it is important to present a clean signal, so either a good VHF RTTY signal or a strong, interference free HF signal, is desirable.

A phase-locked loop demodulator is normally tuned for the frequency and bandwidth desired. Here, the 0.022 µF capacitor from pin 13 to pin 14 of the integrated circuit and the 20 k resistor (an 18 k fixed and 5 k variable) on pin 12 set the center frequency to about 2125 Hz, midway between a 2025 Hz mark and 2225 Hz space frequency.

Bandwidth needed to allow 300-baud transmission is set by the 200 k resistor between pins 11 and 12, with additional trimming provided by the filter of the 0.005 µF capacitor and 100 k resistor coming from pin 8.

Naturally, with a circuit operating at TTL levels, the output from this one-chip wonder is at TTL levels. So don't try to drive a Model 15 with it—at least not directly. To interface the demodulator with the RTTY loop, we use one of my all-time favorite devices, an optoisolator, to convert either a TTL level or RS-232 level to the more common, for TTY, that is, current loop.

Before we get too deeply into the circuit, though, perhaps a word or two about the optoisolator may be in order. You might think that converting the high-level loop current to the low-level RS-232 or TTL current might be accomplished with some resistors, or a transformer, or some such device. Well, while you might be able to effect some information transfer that way, there is an inherent danger. If the transfer circuit were to fail, high-level current might be allowed into the TTL device. At a minimum this would fry some components. Maximally it could be quite dangerous.

For this reason, various schemes have been introduced to isolate the loop from a driving circuit. While a relay might seem obvious, conventional relays are too slow to keep up with the keying pulses of RTTY.

One version of relay that can be used is the reed relay. This little beauty consists of two thin reeds of magnetically active metal sealed in a glass tube. Either a permanent magnet or electromagnet will cause the reeds to react, making or breaking the circuit. Thus, driving the magnet from the loop can allow the reeds to key a low-voltage device. This may be ideal for a keying circuit, but the reeds cannot handle the current to key the loop itself.

Continued on page 74

For XR-2211 RTTY Demodulator:

IC: XR-2211

Resistors (1/4 or 1/2 watt: Radio Shack parts are nearest whole values): 5.1 kΩ, 18 kΩ, 100 kΩ, 200 kΩ, 510 kΩ

Potentiometer (miniature PC mount): 5 kΩ

Capacitors (precision disk): 0.022 µF, 0.005 µF, 0.0047 µF, 0.1 µF x 3

Perfboard: 0.1" grid

For RS-232 to TTY Converter:

Optoisolator: 4N33

Resistors (1/4 or 1/2 watt; Radio Shack parts are nearest whole values): 220 Ω, 4700 Ω, 10 kΩ

Diode: 1N4004

Transistors: 2N2222, MJE3055

Perfboard: 0.1" grid

Table 1. Parts list.

• Remember that, besides the station you are working, there are other hams, shortwave listeners and scanner fans listening as well. What would your mother say if she heard you talking like that?

Amateur radio includes some of the finest people it has been my pleasure to encounter. We have the opportunity to be the last refuge for common courtesy, even when the rest of society seems to have no interest in being polite. On the HF bands, we realize that we are goodwill ambassadors to our contacts in other countries, but hams throughout the globe give each other the benefit of the doubt. Now that our contacts are no longer limited to the planet Earth, and more people are listening to us, we really need to present ourselves as competent and courteous. 73

Ham Radio Fun

The Shelby Hamfest

What are you doing the weekend before Labor Day?

Larry G. Ledford KA4J
553-4th Street S.E.
Cleveland TN 37311
[ka4j@juno.com]

One of the fastest-growing hamfests in the South is held in Shelby, North Carolina.

While it is smaller than the Dayton hamvention®, it bears many similarities. Both are held in smaller communities in their respective areas and attract larger crowds than their larger-neighbor hamfests.

I had the pleasure of attending the 1997 hamfest, which was the 41st year it had been held. Shelby's been called the "Grand-Daddy of them all," and between 12 and 15 thousand visitors were expected. From the looks of the parking lots, attendance was close to that. As with all good hamfests, there was a good mix of used ham gear in the flea market area, new gear inside the buildings and some computer stuff and those odd related items that defy description in both. Very enjoyable.

Photo A. Hams from all over, ready to tackle the sea of tents in the distance.

Where is Shelby?

It's just off Interstate 85, but still slightly off the beaten track. It's about 40 miles from Charlotte and 75 miles from Asheville. Granted, it is a bit hard to get to, particularly from my QTH in southeastern Tennessee, but well worth the trip. I would have had an easier route but Interstate 40 was closed at the Tennessee/North Carolina state line due to a massive rockslide that took months to clean up. The shortest (but not the quickest) route for us was through the mountains of Tennessee, Georgia, South Carolina and North Carolina. This takes you through the areas of two wild rivers: the Ocoee, in Tennessee, and the Nantahala, in North Carolina. Both are very scenic and canoes, kayaks and rafts are everywhere. While we set no speed records, we saw some very beautiful rivers and mountains.

Photo B. Judging from the intent looks on these faces, bargains abound.

The hamfest is held at the Cleveland County Fairgrounds on US 74 Business Loop at NC 180, about three and a half miles from Shelby. It was a bit dusty due to the dry weather but that made for easier walking. A regular participant said that it had rained the last four years at the hamfest. It is scheduled for the weekend preceding Labor Day each year.

The hamfest has two firm rules: No "adult" videos or discs are allowed to be sold or displayed, and no firearms are allowed on the premises. This promotes more of a family-type event, one that will bring more people. It would be nice if *all* hamfests adopted these rules.

What did I find? An Alinco DJ-11, the new shirt pocket-sized HT and an older Drake TR-3 sideband transceiver (I collect low band rigs). On Sunday I found two bargains: a WRL Galaxy 300 for $6 and a 486 motherboard running at 33 MHz with 16 Meg of RAM and a video board for $25.

There are several very good restaurants in the area and one is an outstanding steak house. It's called Kelly's, and is about 15 miles away, over in South Carolina. That meal was to repay my wife for carrying the stuff to the car (you married men will understand).

Why not plan to attend in 1998? For specific information you may contact the Shelby Hamfest Web site at [http://www.shelby.net/n4fan/]. 73

Roamin' Romania

Part 2: Amateurs of the Jiu Valley.

George Pataki WB2AQC
84-47 Kendrick Place
Jamaica NY 11432

In the fall of 1997, while visiting my home town of Timisoara, Romania (see Part 1, June), I took a side trip to see the radio amateurs in Hunedoara County. The area known as the Jiu Valley is a mining region. The visits were organized by George YO2BBB, the chief of the radio club of Hunedoara County, located in Deva. During this trip I saw radio amateurs in Deva, Orastie, Beriu, Calan, Hateg, and Petrosani, and one on Parang Mountain.

Deva

From Timisoara I took a train. After about three and a half hours I was met by George YO2BBB at the Deva railway station. I had my tag with my name and call pinned to my jacket, so I was easily identified.

Deva, with about 80,000 inhabitants, is a university center. The Deva Fortress, built in 1241 on the top of a nearby hill at 1225 feet, is on the site of a Roman *castrum*. These days it is in ruins. The reason is that during World War I, while it was an ammunition depot, it blew up. They don't build fortresses like they used to, I guess—this one did not even last 700 years.

George YO2BBB took me to his house where I stayed while in Deva, which is also the county seat. This city, and the entire county, is rich in amateur radio activities, due in large part to the work and skills of George, who has been employed full-time by the radio club for more than 30 years. One can say that George is a professional amateur.

First, George took me to the county radio club, which has several rooms. One is for the station YO2KAR, sometimes using the YO2KHE call; others are used for meetings, workshops, QSL bureau, etc. There I met Felicia YO2LIP, licensed in 1996, the club's secretary and trainer for direction-finding competitions. She has the prestigious title of Master of Sport, and happens to be George's daughter-in-law. Her husband Marius is YO2CWR, George's wife Doina is YO2CGV, and George and Doina's daughter Georgeta is married to Artur YO2COC.

You might say that George YO2BBB is the undisputed head of a reigning amateur radio dynasty. Everybody in this family is involved, in one way or another, with ham radio. Most of them are direction-finding (foxhunt) champions several times over.

The club station has a factory-made transceiver and a homemade linear with the final tubes installed temporarily

Photo A. Maria YO2LHW, a secretary, shares the shack with radio technician and husband Adrian YO2BPZ. (Reportedly, their favorite and most *read ham magazine*—ahem—*was too dog-eared to be put on display.)*

outside the cabinet, there being no room inside. In this case, "temporary" lasts a very long time. The antenna is a wire dipole.

At the radio club I met many local hams. Dem YO2CMH, licensed in 1980 and a chemical lab technician in the mining industry, is a builder and experimenter. Sorin YO2DNY, licensed in 1985 and an electronics engineer, likes two-meter contests. Marin YO2LMS, licensed in 1995 and an auto mechanic, is a builder and a two-meter contester. Ioan YO2LCV, licensed in 1988 and a lathe operator, is a builder and contester.

George YO2BJS, licensed in 1975 and a retired electronic technician, is a builder who works mostly on SSB. Adrian YO2BPZ, licensed in 1976, handles radio communications for the civil defense. Cori YO2LAG, licensed in 1986, is a retired policeman. Marcel YO2BJZ, licensed in 1975, is an electronics technician and master builder.

Gratian, operator at the YO2KAR club station, is a military firefighter and builder who operates mostly on two meters. Bela YO2LOH, licensed in 1997 and a retired electrician, works only on two meters. Vasile YO2LEG, licensed in 1990 and an electrician, is a builder. Liviu YO2CC, licensed in 1960 and a retired electrical engineer, is also a builder. Most of these hams built their own stations from scratch; very few have access to factory-made equipment. All claimed to have QSL cards. A favorite local joke goes: A child asked his father, a ham operator, "Dad, does every fairy tale start with 'Once upon a time'?" "No, son. Some of them start with 'QSL is no problem, I'll mail it tomorrow.'"

I photographed many hams at the radio club and some of them at their personal stations. Adrian YO2BPZ is an active fellow; with the help of his wife Maria YO2LHW (**Photo A**), he is publishing a quite interesting four-page monthly bulletin, the *YO/HD Antena*. They have also edited and published a service manual for the A-412 Romanian transceiver, as well as an amateur radio glossary in 45 languages. Maria YO2LHW, licensed in 1993 and a secretary in a trading company, works on two and 80 meters SSB.

Photo B. Ioan YO2LHZ is a mechanic in "real life."

Celino YO2BMI, an electromechanical engineer, is a typical success story of the new freedom in enterprising, and the free market system which started in the recent years in the Eastern Europe. He owns eight furniture stores in various cities of this county. Celino, licensed in 1971, is the president of the local amateur radio association. He uses a Yaesu FT-840; a 14AVQ antenna; a dipole for 17 meters; a five-element rotatable yagi for two meters; and a vertical for 70 cm. YO2BMI has a computer with Windows 95 and a CD-ROM with the *Callbook*, and does computer logging. He is a reliable QSLer, has a nice card, and has over 150 countries towards his DXCC.

Cori YO2LAG, the retired policeman, has a very small homemade transceiver, works on two meters and on 80 meters SSB, and has QSL cards.

Orastie

Celino loaned us a company car to take George YO2BBB and me to Orastie, 17 miles east of Deva. This municipality, located at 760 feet, is a very old cultural center, mentioned by document in 1224. There we met Ioan YO2LHZ, licensed in 1994, a mechanic

Photo C. Liviu YO2LEU is a retired telephone operator active on two meters.

Photo D. Retired mechanic Mike YO2QY has over 290 countries confirmed.

(**Photo B**); Liviu YO2LEU, licensed in 1990, a retired telephone operator, very active on two meters (**Photo C**); Miron YO2LHY, licensed in 1994, a retired mechanic for farm machinery; Theo YO2CKO, licensed in 1979, an auto mechanic, builder and operator on 80 meters SSB; and Ioan, a short-wave listener waiting to take the license examination.

We visited the personal station of Liviu YO2LEU, who is visually handicapped and seems always to be on two meters. Wherever I went in various cities of this county, when I listened on the two-meter band, Liviu was there.

Beriu

From Orastie I went to the nearby small village of Beriu to see the station of Ioan YO2LHZ. Ioan uses a combination of old military surplus equipment and homemade accessories. He works on the two- and 80-meter bands.

I observed that there is a lot of traffic on these two bands, especially in the afternoon and evening hours. After Beriu I returned to Orastie.

Then, in Celino's company car, George YO2BBB and I went through Simeria to Calan.

Continued on page 68

Photo E. Nicu YO2CBK is the radio teacher at YO2KBY in Hateg.

Roamin' Romania
continued from page 67

Calan

The town of Calan used to be an important metallurgical center; nowadays, many of its facilities are closed down. Here I had the pleasure to visit Mike YO2QY, with whom I had QSO'd and exchanged cards (**Photo D**). His card is on the wall of my radio room. Mike, licensed in 1963, is a retired chief mechanic and skillful builder, as well as a contester and DXer with over 290 countries confirmed. YO2QY is a passionate ham operator, but his license was suspended from 1983 to 1990, when he was investigated and harassed by the *Securitate*—the secret police of the former dictatorial regime. The reason? His amateur radio contacts. It was a difficult period for him, as it was for his entire family. Mike uses a Swan 350, a 14AVQ, and an inverted V for the 80-meter band. He has over 300 awards and a nice photo QSL card, and is a reliable QSLer.

We also went to see Feri YO2ARV. Licensed in 1968, Feri is a chief electrician. He is using an FT-DX505 with a separate VFO, a homemade linear amplifier, an electronic keyer, and other gadgets made by him. He has a 12AVQ and a Windom antenna for 40 and 80 meters. YO2ARV has worked over 300 countries for his DXCC and has over 450 awards. He is a builder, experimenter, and contester, and has two types of QSL cards.

After Calan, we returned to Deva. The next morning, George YO2BBB and I went 35 miles south to Hateg.

Hateg and Petrosani

Hateg is another small but very old town, first referred to in 1247. Here we went to the Children's Club, established in 1984 and home of radio station YO2KBY. Nicu YO2CBK is the teacher and chief operator (**Photo E**). Licensed in 1978, he is a builder, experimenter, and contester, and operates both CW and SSB. The children learn the Morse code, build simple electronic projects, and operate the club station on 80-meter SSB. From his personal station, Nicu operates SSB on the 10-40-80 meter bands with a sloper, and on two meters with a rotatable nine-element yagi.

The club station is homemade. The antennas are a delta loop for 40 and 80 meters, and a ground plane for 10 meters. At the club I met several children, some already with their own callsigns: Marius YO2LNL, age 11; Alin YO2LHK, age 12; and Flaviu YO2LHM, age 10 (**Photo F**).

Photo F. Marius YO2LNL (age 11), Alin YO2LHK (12), and Flaviu YO2LHM (10) find the propagation good for smiles.

We saw Marcu YO2BVH, licensed in 1960, a retired radio technician at the post office. Marcu, now 77, used to be active on CW and SSB with a homemade five-watt station and a wire dipole. His table is full of equipment, absolutely everything made by himself.

We also met Tony YO2LMA, licensed in 1996, a mechanical engineer

Photo G. Maria YO2BJX is an electronics engineer and world-famous (as of now) high-speed chauffeur.

Photo H. High school students Robi YO2LMT, George YO2LLV, and Bianca (SWL) show off the Petrosani Sports School's shack.

working for the bus company. Tony is a builder. He has worked over 100 countries on 80 meters, CW and SSB, with his homemade 50-watt transmitter and a multiband wire dipole. His station is strictly one-man: one chair, no table, built in a closet. He has a picture QSL card showing sights from Hunedoara county.

From Hateg, Maria YO2BJX, a pretty and very active lady (**Photo G**), drove us southeast about 28 miles to Petrosani, elevation 2,000 feet, the center of the region's coal fields. The ride was scary; Maria drove fast on narrow, winding, mountain roads. Slow-moving carts, pulled by horses, without the required lamps, often showed up unexpectedly in the dark. I prayed not to become a news item in

Continued on page 70

Photo I. Feri YO2LAH uses a 10-element yagi for two meters.

Photo J. Sever YO2BUJ is a retired mining engineer and devoted builder.

Roamin' Romania

continued from page 69

the next morning's paper: I am a modest man and shun publicity.

We arrived at Petrosani in the evening and went directly to the High School for Sports. There the principal is Eugen YO2QC, and the professor at the radio club is Bela YO2LEP. We met a bunch of local hams, made the schedule for the next day, and went to sleep in the house of Paul YO2CXY. About the schedule: After long discussions, three different plans were made—one after another—but the next day we followed none of them.

At the school there is a radio room where the children study Morse code and can build some gadgets.

There is also radio station YO2KBE, where several licensed young operators were on hand: Robi YO2LMT, age 15; George YO2LLV, age 14; and Andrei YO2LNW, age 16; as well as Bianca, Dan, and Raul, shortwave listeners and club operators without personal callsigns (**Photo H**). The station is home-brewed and they have a computer.

Photo K. Eugen YO2QC holds the title of Master of Radio Sport.

I also visited a couple of personal stations. Zoli YO2CPV, licensed in 1980 and an electrical engineer, is a master builder operating CW and SSB with a homemade station and a multiband dipole. His shack is in a narrow, built-in storage compartment—he barely fits in. Zoli has QSL cards.

Iosif YO2CJ, licensed in 1952 and a retired mining engineer, showed us his dashing black miner's uniform. Iosif is a tinkerer and experimenter, a specialist in antennas, a contester, a DXer with over 220 countries. He is using the Drake line, some homemade accessories and a computer. YO2CJ is also the author of three popular books: two about HF antennas, and one about VHF and UHF antennas.

He wanted to give me a miner's lamp as a souvenir, but I had to turn him down. The gift was too bulky and heavy to carry, and I don't have any mines where I can use it.

Paul YO2CXJ, licensed in 1980, is the president of the Jiu Valley Amateur Radio Association. He is a geology engineer teaching at the local university. Paul is a master builder, a contester, and a DXer with over 180 countries worked for his DXCC. He has a neat station with an FT-DX500 and a bunch of homemade equipment; his antenna is multiband wire dipole. His 15-year-old son, Victor YO2LLU, was licensed in 1996 and is a high school student. He operates SSB on 80 meters and so far has worked 50 different countries. Paul's wife Tania, a certified translator for three or four languages, is a shortwave listener.

Feri YO2LAH, licensed in 1985, is an electronics technician (**Photo I**). He is using an SB-102 with dipoles for 20 and 80 meters, and a longwire for 10 and 15 meters. For two meters, he has a 10-element yagi. YO2LAH is a builder, a contester, and a DXer with over 220 countries worked for his DXCC. Feri has QSL cards.

Sever YO2BUJ, licensed in 1974 and a retired mining engineer, is a builder (**Photo J**). With his 40-watt homemade transceiver, a wire dipole for 10-40-80 meters, and a nine-element yagi for two meters, Sever has worked mostly Europeans. He is constantly

changing, improving his gadgets, and nothing stays the same for a long time. Sever also has QSL cards.

Andy YO2AXY, licensed in 1970, is an electrical engineer. He is a tinkerer, building transceivers and various accessories. His FT-757GX is now pushing 100 watts into a horizontal delta loop. YO2AXY has worked over 200 countries and has QSL cards. His son Claudiu is waiting for his license.

Last but not least, I visited the personal station of a family of radio amateurs: Bela YO2LEP, the radio teacher from the sport school; his wife Maria YO2BJX, an electronics engineer involved in various businesses; and their son Andrei YO2LNW, a high school student. Andrei has computer-generated QSL cards.

Maria was the one who drove us from Hateg to Petrosani and made me see my whole life flashing before my eyes, with several fast reruns. Later she took us from Petrosani back to Deva, another unforgettable experience.

Parang Mountain

Eugen YO2QC was licensed in 1962 and is the principal of the High School for Sports (**Photo K**). A former gymnast on the Romanian national team, he holds the prestigious title of Master of Radio Sport, and several times was national champion on two meters. He has two stations: one in Petrosani, and the other at the ski center of the sport school, on Parang Mountain, with an elevation of over 5,900 feet.

There he is using a TS-830S with a longwire for 10 to 80 meters; a ground plane for 10 meters; a two-element quad for six meters; a nine-element yagi for two meters; and two connected nine-element yagis for 70 cm. At that elevation, he can work DX even when loading a proverbial wet noodle. I worked YO2QC and promptly received his QSL.

Also in Eugen's care is a two-meter repeater installed on a tower right near his little homemade chalet.

To reach the ski center, Maria YO2BJX drove us from Petrosani to the site of a ski lift. There we had to jump on a moving chair hung on a steel cable, going in about 25 minutes from elevation 3,630 feet to elevation 5,940 feet. The system has 130 double chairs, moving sometimes at a height of 160 feet above ground. A cold wind was blowing, George YO2BBB was wiggling around near me on his chair, and I was scared; I think I had every right to be.

Bela YO2LEP and some of the young amateurs also came up: Laura YO2LNU, Constantina YO2LLW, George YO2LLV, and Cosmin, a shortwave listener.

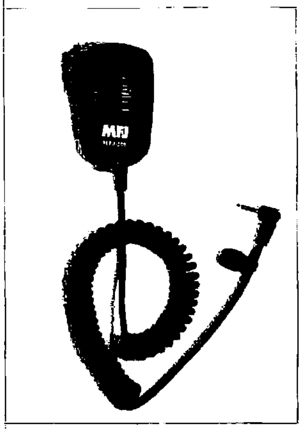
All's well that ...

Yes, it ended well. I got off the mountain—frozen, but in a single piece. With George YO2BBB I returned to Deva, spent the last night there, and then in the morning I took the three-and-a-half-hour train ride back to my home town of Timisoara.

After a couple of days, I went to the airport and passed through the annoying Romanian customs. Why was it annoying?

Well, because the customs officer looking at my luggage through his X-ray machine saw something that he was not supposed to see, and asked me to open the suitcase. I had two identical suitcases, so I opened the other one. An honest mistake—it could happen to anyone. But there was nothing in that suitcase, just a bunch of books and QSL cards. I passed that test with flying colors—and after about nine hours in the air I was safe and sound in New York City. 73

NEW PRODUCTS



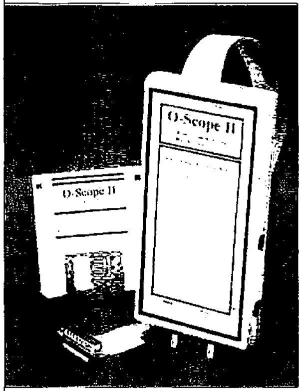
MAKE YOUR YAESU HT EVEN HANDIER!

Got a Yaesu FT-10R, FT-40R, FT-50R, or VX-1R? The new MFJ-295Y YAESU Mini-SpeakerMic™ is made to give your Yaesu handheld superb crystal-clear audio. It's incredibly lightweight, made of high-impact water-resistant plastic, and uses a one-quarter-inch speaker to produce 83 dB of brilliantly clear audio. It's got an eight-position swivel lapel clip and three and a half-foot stretchable cord for hands-free, move-as-you-like use, and a built-in earphone jack for private listening. MFJ has priced all these features and more at $15.95, and of course it comes with MFJ's *No Matter What*™ one-year limited warranty.

To order or for information about your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises. com]; or check out the Web site at [http://www.mfjenterprises. com].

INTUITIVE CIRCUITS' VERY FIRST!

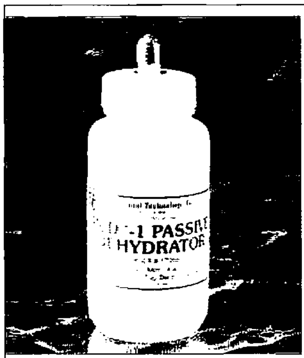
Here's the very first product from Intuitive Circuits, LLC: the DTMF-8 decoder board. It's great for remote control of most equipment (like repeaters) via radio—or any other audio source, with its eight relay outputs. Relay contacts are rated at 1 A and can be programmed for momentary, latching (or combination), or mutually exclusive one of eight. Password programming adds security and allows multiple DTMF-8 boards attached to the same audio source to control even *more* equipment—and it's only $119! For more information, contact Intuitive Circuits, LLC, 2275 Brinston Ave., Troy MI 48083, or check out their Web site at [http://www.icircuits.com].



DOES THE WORK OF SIX — AND NOW IT DOES WINDOWS!

Allison Technology Corporation has released the O-Scope II for Windows™. Now the O-Scope II digital storage oscilloscope module has both DOS and Windows™ operating programs. The O-Scope II, which as everyone knows, does the work of six other instruments (dual-trace storage oscilloscope, digital voltmeter, frequency counter, frequency spectrum analyzer, data logger, and X-Y display mode), converts a PC into an advanced digital storage oscilloscope and data logger. Data may be captured to disk or transferred to other Windows™ programs. Display screen data may be captured graphically for printouts or may be converted to graphic images. The modules are small, low-cost, and lightweight, making them suitable for portable operation as well as for the crowded workbench. The O-Scope II works with standard scope probes and is powered from 12 VDC. ATC offers a variety of probes for the unit, including standard attenuating probes, high-voltage probe, differential probes, and automotive ignition probes. The O-Scope II sells for $349 including the module, manuals, AC power adapter, cable and both the Windows™ and DOS software packages.

To order or for more information, contact Allison Technology Corporation, 8343 Carvel, Houston TX 77036-6301; call them toll-free at (800) 980-9806.



DRIER IS BETTER

Environmental Technology, Inc., introduces the new RCD™-1 and RCD™-2 Passive Dehydrators. They're super-inexpensive, require no electric power, and will protect microwave and satellite earth station waveguide, coax and other RF components from moisture condensation and performance-robbing corrosion.

Both the RCD™-1 and the RCD™-2 are ideally suited to fixed, portable, and mobile station applications having limited or no power availability, including general-purpose dehydration and equipment protection during shipping and storage, or to back up mechanical dehydrators in emergencies. They use an inert desiccant blend that changes color to let you know when it needs replacement or regeneration—usually around every 18 months.

For more information contact Environmental Technologies, Inc., 1302 High Street, South Bend IN 46601. Call (800) 234-4239 (US and Canada) or (219) 233-1202 (elsewhere).

SAFETY BOOK

Concerned about RF exposure safety? *RF Exposure and You*, newly published by the ARRL, will explain the new FCC rules designed to ensure that you, your family, neighbors, and anybody else at risk, are exposed only to low levels of radio frequency energy. Worksheets allow you to determine whether or not your station is in compliance, and if not, there are comprehensive, plain-English instructions on what to do about it. Included are reprints of the FCC documents, a review of basic electromagnetic theory, and tables to simplify determining compliance with the new rules. You'll also find a list of additional resources and FCC information sources, primarily on the Internet.

RF Exposure and You (ARRL order #6621) is available from amateur radio dealers for $15.00 retail, or you can order from ARRL. Call (888) 277-5289; FAX (860) 594-0303; or send check or money order for $15.00 plus $4.00 s/h to ARRL Publication Sales, 225 Main St., Newington CT 06111-1494.

Number 74 on your Feedback card

Carr's Corner

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Radio way-backs

One of the things that has interested me over the years is to look back over radio history. When I was a pre-teen, the late Hal Wilcox W4OP invited me and a couple of other boys to go with him to a ceremony one Saturday morning. Most of us were pre-hams as well as pre-teens, but were hanging around the now defunct Falls Church Radio Club in Virginia while trying to qualify for our Novice, Technician and/or General Class licenses. The local radio clubs were invited to the decommissioning of the Navy's first radio station, NAA, in Arlington, Virginia (the callsign has since been reassigned to the VLF station at Cutler, Maine), and Hal thought it would interest us young 'uns.

The station was put into commission in 1913, and had a trio of high towers (**Photo A**). In 1940 those towers were removed because they were only two miles from the end of the runway of Washington National Airport (now Ronald Reagan Washington National Airport), which was then being built. Can't have aircraft flying into those towers, after all. The towers were reassembled near Annapolis, Maryland. The site (701 South Court House Road, Arlington VA 22204) is still in use. For a long time it was occupied by the Defense Communications Agency (DCA), and shows up under that name on a lot of local maps. But the current user is actually the Defense Information Systems Agency (DISA), which absorbed DCA some years ago.

The old NAA used a number of transmitters (**Photos B** and **C**), including powerful spark gaps and Alexanderson alternators. One source book, published by Naval Research Laboratory (which operated NAA at one time) claimed that the station operated on 113 kHz with a power of 100 kW.

CW is gone? More or less

The US Coast Guard (USCG) is the federal government agency primarily responsible for carrying out the United States' obligations (under the Safety of Life at Sea Treaty) for the protection of life and property at sea. While its law enforcement duties tend to grab the headlines more often today, especially in the war on drugs, the USCG has been in the forefront of protecting those at sea for as long as anyone can remember.

Indeed, the Coast Guard has maintained a manned radio watch on 500 kHz and other international radiotelegraph (CW) hailing frequencies for all but a few years of this present century ... nearly 100 years. Coast Guard radiomen spent endless shifts listening for the staccato SOS that indicated a ship or smaller vessel in distress on the high seas.

I can recall that one of my ham radio mentors (from the 1950s), another member of the old Falls Church Radio Club, was a captain in the USCG. He spun tales of rescues at sea that would chill the spine—men battling 40-foot seas in 12-man whaleboats to rescue the crews of ships breaking apart in storms.

He told me that, when he was a newly-minted ensign, his skipper put him in charge of a two-boat party to effect a rescue in somewhat less vicious seas, and gave him the choice of using motorized boats or the 12-rower whaleboats. He thought for a moment, and selected the whaleboats. It turned out to be the right choice: 12 men, rowing for their lives, can keep the oars in the water, while the propeller of a

RTTY Loop

continued from page 63

Here we must bow to another form of subterfuge, the optoisolator. Most of us are familiar with photocells, those little wonders that change resistance based on the amount of light falling upon their faces. When I was in school, we marveled at how a transistor, with the top cut off the case, makes an excellent photocell. Of course, you can buy transistors prepared this way (phototransistors, naturally).

Anyway, you are also aware, no doubt, of the illuminating wonders known as Light Emitting Diodes, or LEDs. Able to produce light from relatively low energy sources, these darlings find their way into almost every electronic device imaginable. Now, if you take an LED and pot it so that it shines directly onto a phototransistor, you have an optoisolator. The output is directly controlled by the input, but there is no electrical connection, the transfer being accomplished over a beam of light.

Admittedly still at low level, now you can use the output of the optoisolator to key a transistor, and that transistor to key another, power, transistor, and that transistor to key a loop. Simple, huh? Well, **Fig. 2** shows the results.

Although the diagram shows the input as "RS-232 Levels," TTL levels should work nicely, as well. The key purpose is to light up the LED in the optoisolator.

The rest of the circuit is fairly conventional, and may be built on perfboard, with point-to-point wiring, or on a printed circuit board.

The power supply requires a 12 volt supply for the transistors, and a more typical loop supply for the TTY machine. Be careful around those loop supplies, folks. They can deliver quite a kick if you lay your hand across the terminals.

See what happens when you ask a question? All kinds of information can flow your way. Check out the "RTTY Loop" Web site at [http://www2.ari.net/ajr/rtty/] for more goodies in and about the column; and send me your comments, questions, and suggestions at the above E-mail or snail-mail address. See you next month, on the RTTY Loop.

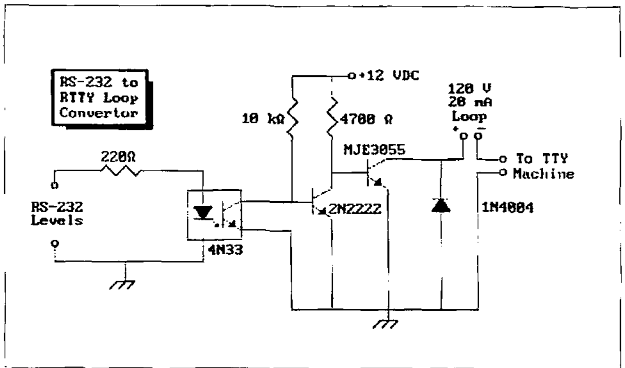


Fig. 2. RS-232 to TTY converter.

motorboat is out of the water much of the time in heavy seas. A motorboat will only give you the maximum that the engine can produce, while men seem to be able to exert superhuman effort when called on to do so.

He also told me that the skipper of his Coast Guard cutter told him in no uncertain terms that, even though he was the officer, that on this, his first rescue, the chief petty officer who was commanding the other boat party was the "real boss" and was to be obeyed.

If you want to read something about the Coast Guard today, then I highly recommend *The Perfect Storm*, which was until recently on the bestseller list. This book details the storm that combined a nor'easter, Hurricane Gloria and a third storm out of Canada over the Grand Banks. It produced waves over 100 feet high, with average wave heights on the order of 50 or 60 feet. In order to rescue first the crew of a sailing yacht, and then the crew of a small boat sent to rescue the yachtsmen, a "coastie" rescue swimmer went into those 60-foot waves not once but three times. When I finished reading that passage I had to ask, "Where the hell do we get such men?"

The US Coast Guard has ended its manned radio watch on 500 kHz—the last CW frequency. Automatic signaling alarms have replaced the "fist" of the Morse code radio operator. Satellites and automatic navigation beacons have long since replaced the Morse code as the primary means of communications, and now, the only means of communications: Morse is essentially gone for emergency purposes (tuning between 400 and 510 kHz will still show some CW communications activity, however).

On April 1, 1995, with a number of local radiomen gathered for the end event at the Coast Guard radio station at Chesapeake, Virginia, the "big switch" was thrown for the last time at 7:19 p.m. EST with the end of the last Morse message transmission. Similar shut-offs occurred at Coast Guard radio stations at Boston, Miami, New Orleans, San Francisco, Honolulu, and Kodiak (Alaska). As recently as five years ago, Morse code messages flowed into the Chesapeake station at rates of up to 10,000 per month, but in the last year of operation the total dwindled to a mere 500 a month. Only two SOS calls were received in all of 1994, and none occurred in 1995, according to a story in *The Washington Post*.

Some CW lore

A certain lore is found among CW operators. The "fist" (how one sends dots and dashes) is very personal, and many operators could identify friends simply by their fist. Indeed, the original definition of a "lid" (bad operator) was someone whose fist was unreadable.

One could also tell the fist difference between "straight key" operators, who used the traditional telegraph key, and "bug" operators who used a semiautomatic "speed key." The latter were operated using a side-swiping motion, with the dash manually formed by pushing the paddle to the left, and the dots were formed by pushing the paddle to the right. The dots were "semiautomatic" because they were formed by a vibrating action of the extended arm repeatedly striking a second set of contacts together. In latter years, automatic electronic keyers became popular. Those instruments automatically formed dots and dashes of the correct lengths, and kind of destroyed the notion of a "personal fist" (but made the CW bands a heckuva lot more readable—there were lots of lids on the CW ham bands, and not all of them went to SSB!).

By the way, the world's record for CW reception is 73.5 words per minute (wpm). The record has not been beaten since it was set in 1939 by Chief Petty

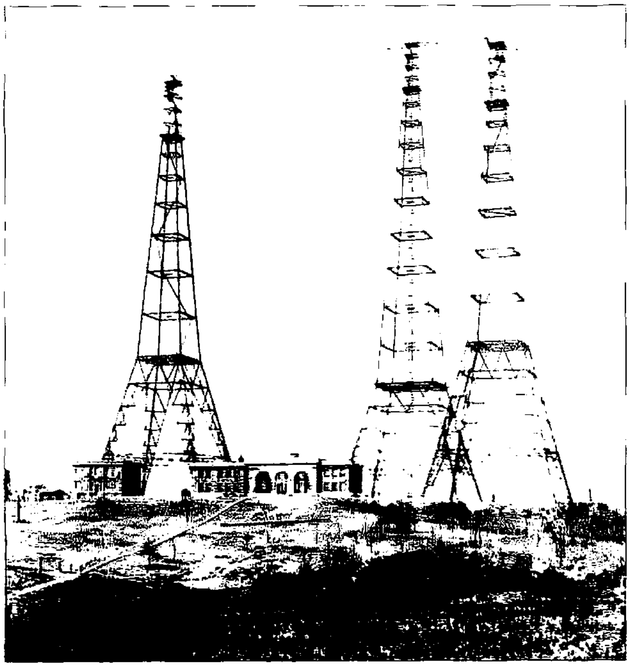


Photo A. The triple towers of the US Navy's first radio station.

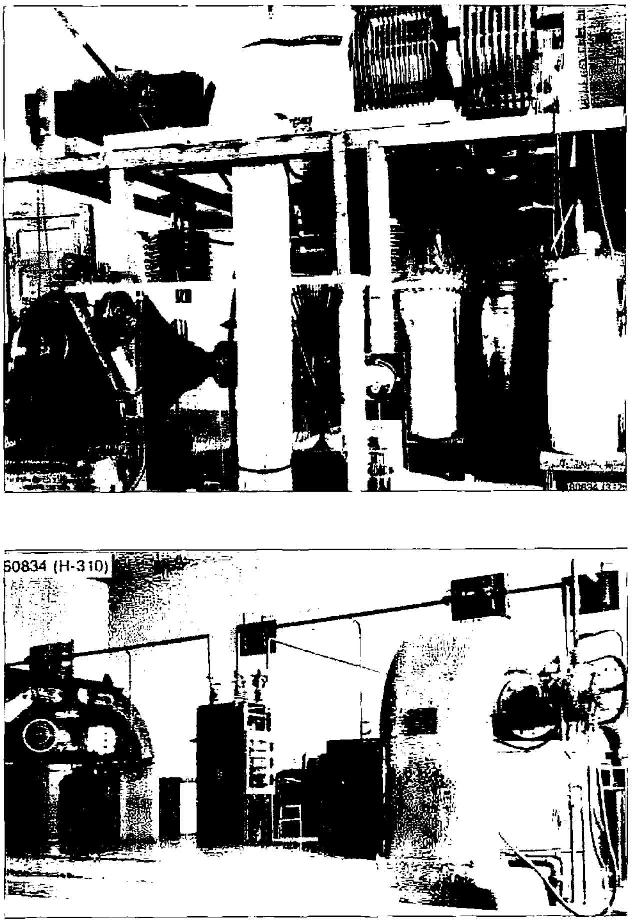


Photo B, Photo C. The NAA transmitters. All photos provided by Naval Research Laboratory.

Officer Ted McElroy, at a contest held at Louisville, KY.

Having grown up around CW operators, and using mostly CW myself even today, I heard a lot of stories about different types of operators. The maritime operators on the high seas were the largest class, but the maritime operators on the Great Lakes had a special "fist" style that marked them apart from the ocean-going operators: the Great Lakes Swing. They sent dashes at the correct length for the speed involved, but dots were sent at a length appropriate for speeds three times faster; hence, the "swing" aspect.

Another distinct class were the aviation CW operators. When radios were first placed in aircraft, the longest range system was CW, rather than voice. The practice of carrying a radio operator aboard aircraft persisted into the late 1940s. World War II movies of American bombers often show the radio operators aboard B-17s with their radio sets. Although equipped with an amplitude modulator for voice, the main mode was CW. As a young ham in the 1950s, we could still buy ARC-5 receivers and transmitters, as well as ART-13 transmitters from World War II military aircraft.

Civilian airline operators developed fists that came to be called the "airline bee-bop." I don't know the details, but would love to hear from some former airline operator who does.

Other operators used a constant dot-dash length "fist" (called the Farnsworth system). They sent out the dots and dashes that make up the individual letters at a speed of, say, 25 words per minute, even if the speed of the message was slower. The space between characters was varied to account for the speed differences.

The golden era

The "golden era" of radio, before World War II, was a time of immense progress in radio design. And the shortwaves, which we use today with ease, were a deep mystery. Radio traffic was carried out on frequencies whose wavelengths were 200 meters or longer (which correspond to the top end of the AM broadcast band and lower). In 1919, the cynical commercial interests convinced the Commerce Department (before the FCC was created) to put ham operators on "200 meters and below" (the shortwaves), because "They'll never get out of their backyards with that ..." Little did they know—ionospheric propagation had not been discovered by that time!

I can recall an older ham (Charlie) who came to our radio club and told of his experiences on the bands in 1921. He lived in central Virginia, and attended engineering school at the University of Virginia. When he left home for his freshman year, he had a three-wire "flattop array" that ran several hundred feet across his father's farm. When he came home for Thanksgiving, the antenna had been replaced by a 40-meter dipole. Not wanting to confront his younger brother in front of the family, he waited until after dinner. "We're using 40 meters, now," was the excuse offered by his brother. Warming up the transmitter and receiver, he tapped out a "CQ, CQ, CQ" only to be answered by a ham with a callsign "8XX." In those days, there were no national callsign indicators (like the "K" in my callsign, K4IPV), but they did have call districts. The "8" indicated West Virginia or possibly Ohio, especially given my friend's location in Virginia. He asked 8XX to relay a message to his college roommate, who lived near Dayton, Ohio. The other ham replied, "Sure, OM, but you're probably in a better position than I am ... because I am *FRENCH* 8XX." Charlie darn near croaked: He'd just discovered ionospheric propagation.

Perhaps in the near future we'll discuss the vagaries and benefits of ionospheric propagation in this column.

Perhaps the crowning achievement of radio's golden era was the invention of radar ("radio detection and ranging") by the British, just in time for the Battle of Britain at the very beginning of World War II. Radar had a rough beginning because many prominent radio scientists of that day didn't believe that enough backscatter signal would be reflected from aircraft to be received with the equipment of that day. But Sir Watson-Watt and his engineers persisted, and created the Chain Home radar system just in time to see German bombers coming over the horizon. The system operated in the HF shortwave bands, rather than in the radar bands.

The first combat use of the radar was not exactly an auspicious occasion. According to a story told in a history of radar (*Race on the Edge of Time*) and other sources, the first use was called the "Battle of Barking Creek." It seems that a French flier escaped from his German-occupied country in a small plane. It was picked up on the Chain Home radar, so a flight of Hurricane fighters was scrambled to intercept the incoming "German." Unfortunately, the first antennas used were dipoles, which are bidirectional. The radar scope, however, was a primitive "A-scan" type that showed signal amplitude versus time. When the Hurricanes lifted off, they were behind the coastal radar in England. They showed up on the A-scan scope as a series of blips behind the "German's" leading blip. To the operators, it looked like the standard *Luftwaffe* formation of a pathfinder out front and a squadron of bombers following. So the Royal Air Force scrambled a flight of Spitfires to intercept what they thought were Germans. The Chain Home radar had a height-finding capability (using sea bounce multipath) with an accuracy of 600 feet. The Spitfires climbed above the Hurricanes, and then dived on them, machine-guns blazing. They never saw the red, white, and blue roundels on the wings, but did note the squared-off canopies (which were similar to those on the Messerschmitts). When cooler heads analyzed the incident, they noted some strange coincidences, and investigated: The Hurricanes were shot down by the Spitfires! That's when the engineers decided to add reflectors behind the dipoles, making a two-element directional beam antenna that wouldn't see landside aircraft as if they were out over the English Channel! Sighhhhhhhhh.

QRX

continued from page 49

not finished construction of the service module where astronauts will live.

The launch was already eight months behind schedule before the latest unexpected change, meaning that the first crew would not arrive until late spring or early summer of 1999. Ham radio is still slated to be an integral part of the station as soon as the first astronauts arrive.

With ISS being delayed again, and few shuttle flights scheduled to carry SAREX gear, don't look for a lot of live ham radio from space except for operations from the aging *Mir* spacecraft.

Meanwhile, NASA has two new astro-hams. They are astronauts Winston Scott and Daniel Tani. Scott is KD5DXD, and Tani is KD5DXE.

Via ARRL, NASA, and *Newsline*, Bill Pasternak WA6ITF, editor.

Got a New Callsign?

Changing your callsign entails a bit of housekeeping. For instance, if you have a new vanity callsign and are active on packet, you should alert the sysop of your packet BBS of your new on-air identity. You'll also need to change the callsign in your packet TNC firmware and in your ham radio software (communication and logging software, for example). If your callsign is also part of your E-mail address, you'll want to update that with your Internet service provider, as well. ARRL field appointees should alert section managers, too. A new callsign also can mean a new club or ARRL field appointment badge, new QSL cards, new business cards (if they carry your callsign or packet or E-mail address) and maybe a new license plate for the car.

The list goes on and on. One thing you *won't* have to do is alert ARRL HQ. ARRL members' callsigns are automatically changed as the FCC database is updated.

From March 1998's *Modulator*, newsletter of the Ft. Myers ARC, Earl Spencer K4FQU, editor.

Are You Burnt Out?

Sure, amateur radio is a great hobby, and the public service that we provide is invaluable. But at the same time, it's possible to get too involved and burn out or overstress yourself. As an aid to determining whether you are a candidate for burnout, rate yourself on a 0–5 scale on the following questions (0 = never, 5 = always), then add up your score and see where you stand at the end of the test.

1. Do you tire more easily? Feel fatigued rather than energetic?
2. Are other club members annoying you by telling you, "You don't look so good lately?"
3. Does sex seem like more trouble than it's worth?
4. Are you increasingly forgetting net schedules, autopatch codes, and newsletter deadlines?
5. Is your Morse code proficiency dropping?
6. Is joy elusive?
7. Do you find that you use the 2 m repeater less these days because you have very little to say to people?
8. Have you held the same office in your radio club for more than two years?
9. Are you afraid to speak up at club meetings?
10. When you do speak up, are you increasingly irritable? More short-tempered? More disappointed in other people?
11. Are you seeing close friends and family members less frequently?
12. Have you stopped looking forward to Field Days?
13. Are you using E-mail rather than packet to get messages to other club members?
14. Are you often invaded by a sadness you can't explain?
15. Have you lost the desire to attend every hamfest within a 150-mile radius?
16. Has each of your last three Sweepstakes scores been lower than the previous year's score?
17. Are you increasingly disenchanted and cynical? (This question does not apply if you are a repeater trustee—that's a requirement for the job.)
18. Do you find yourself stopping at Taco Bell® more often than at Radio Shack®?
19. Do you have an unsatisfactory relationship with other club members?
20. Do you experience feelings that the FCC is actually doing an excellent job?

Now add up your scores and see what you should do about your total:

0–20: You don't have a problem. Run for club president. Convince your spouse to become licensed. Convert your dining room into a ham shack. Plan a DXpedition.

21–40: You show a little stress but this is normal. Are you participating in enough club activities? Make sure all your vehicles have HF capability. Add 40 feet to your tower's height.

41–60: You are a candidate for stress burnout. If a club officer, don't run for reelection. If a newsletter editor, look for a replacement. Join a health club. Stop trying to increase your Morse code speed.

61–80: You are significantly overstressed. Skip the next three club meetings. Take your spouse to a romantic B&B and leave the HT at home. Do not renew your ARRL membership. Sell 50% of your equipment.

81–100: I'm surprised that you can even hold a pencil with your stress level. Resign your club membership. Charter a flight to the Bahamas. Buy a CB radio. Take up bridge and bicycling as hobbies.

TNX to the May 1998 *Q-Fiver*, official newsletter of OH-KY-IN ARS, Susie Scott N8CGM, editor.

Brand New Old Ham

My wife and our kids try hard not to remind me

The days of my lean, trim physique are behind me.

Not "over the hill" but fast reaching the summit,

My hairline recedes while I watch my waist plummet.

I've bags underneath each dimmed eye—

My teeth aren't all there (but then neither am I!).

Cholesterol rises, but arches are falling—

My "get up and go" is, well, constantly stalling.

I'm not an "antique"—please, just call me a "classic"—

(Tho' I've heard some remark, "Why, he's almost Jurassic!")

So why's my face beaming as bright as it can?

My very first contact just called me "Old Man"!

—Jim Knoop KB8SFL; lifted from *The Q-Fiver*, September 1997. They got it from *Worldradio* 12.94.

A Tale of Christmas Passed

An item from January 2nd's *The Sun*, a London newspaper, relates the tale of the lost cellular phone: Rachel Murray planned to surprise her roommate with a gift of a cell phone. She left the gift under the Christmas tree. Later she found only a pile of torn paper. She immediately suspected that friend Tony Dangerfield's bloodhound, Charlie, was the culprit.

Murray started a frantic search of the apartment. She found nothing, but figured that if the phone were turned on, she could dial the number and hope to hear it ringing. So Ms. Murray dialed, and heard muffled ringing coming from ... the sleeping dog's stomach.

At first she thought Charlie was lying on the phone, but then realized where it actually was. The dog was rushed to a veterinarian for treatment. The vet told Murray and Dangerfield to let nature take its course. Twenty-four hours later, Charlie was just fine. If you're wondering about the phone, it works just fine, too!

Continued on page 85

LETTERS

continued from page 7

screen will collect dust (you probably won't believe how much), and you'll want to remove it to clean it. Not cleaning it could lead to overheating your computer. Disassembling your computer several times a year is not good for it, or you. An externally mounted screen would be better, perhaps fastened into a frame with a hinge and thumbscrew for easy removal and cleaning.

Lastly, soldering capacitors across the input power leads is probably unnecessary. Most power supplies these days have RF suppression circuitry built right into the power cord connector socket. Computer switching power supplies would give off a lot of RF noise without them, and would never pass FCC Class B ratings. Save this step for absolute last, if you have done everything else and still can't get the interference to go away.

Another thing Jim doesn't mention is the video cable. Most modern monitors have hefty ferrite chokes on the cables already, but it can't hurt to check. If there is a large plastic mass on your video cable, either molded in or snapped around it, that is the ferrite core.

If not, you may want to pick one up at Radio Shack™, or from your favorite electronic supplier.

Jim Kocsis WA9PYH, South Bend IN: Chris, I agree with you on each point. However, I think the wrist strap and motherboard connector issues were covered adequately. You brought up some very good points that I did *not* cover—so, readers, please observe his additional precautions.

You apparently have had more experience with PC servicing than I. I'm going to observe these additional precautions next time I get my hands in a PC. Thanks for your additional suggestions, Chris!

Robert Beasley K6BJH. Regarding the item titled "The Old 73," in the QRX feature (April *73*), Paul Valley has his facts somewhat askew. The name "Peacemaker" was not given to the Colt .44 single-action revolver. That appellation was accorded to the Colt single-action .45, also known as the 1873 army model. The .45 was designed specifically as the US Army official service revolver, but found great favor in the civilian market, especially among lawmen and cattle drovers in the Old West.

There was, however, one problem. The aforementioned also carried the Winchester 73 rifle or saddle carbine chambered for the .44–40 cartridge. This meant that two different types of ammunition had to be carried, which was a little unhandy on the trail or in a mounted posse. While the two cartridges were very similar, they were not interchangeable. At the behest of those carrying the two different types of weapons, Colt introduced in 1878 the single-action revolver chambered to accept the .44–40 cartridge for the civilian market, and it was given the name "Frontier Model." Now the cowpunchers and lawmen could carry one cartridge for both their carbines and handguns.

SPECIAL EVENTS

continued from page 41

will be mostly on 7085 and 14085. Operators of the club will man the station from 8 a.m.–4 p.m. daily. A special 8 x 10 certificate is offered for contacts with proper QSLs. QSL to *Wayne Pennings WD9FLJ, 913 N. Mason, Appleton WI 54914 USA.*

AUG 15–17

ENGLEWOOD, NJ The Englewood ARA, Inc. invites all amateurs the world over to take part in the 39th Annual New Jersey QSO Party. For further details, contact as soon as possible, *Englewood Amateur Radio Association, Inc., P.O. Box 528, Englewood NJ 07631-0528 USA.* Send a #10 size SASE for a reply. The contest will be held from 2000 UTC Saturday, August 15th to 0700 UTC Sunday, August 16th, and from 1300 UTC Sunday, August 16th to 0200 UTC Monday, August 17th. Phone and CW are considered the same contest. General call is "CQ New Jersey" or "CQ NJ." New Jersey stations identify themselves by signing "DE NJ" on CW, and "New Jersey calling" on phone. Frequencies: 1810, 3535, 3950, 7035, 7135, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50–50.5, and 144–146. The Englewood ARA suggests phone activity on the even hours; 15/10 meters on the odd hours (1500–2100 UTC); and 160 meters at 0500 UTC. Logs must show the UTC date and time, QSO exchange, band and emission, and be received not later than Sept. 12th, 1998.

NEVER SAY DIE

continued from page 5

of abductees who have been hypnotically debriefed tell stories of Martians coming to Earth about 65 million years ago when a planet, which comes through our solar system every 65 million years, wiped out Mars' atmosphere and did enough damage to Earth to extinct the dinosaurs. The ETs tell a story of what's left of the Martians living underground or in domed cities. Their ships (UFOs) bring needed supplies from Earth. Since they're millions of years ahead of us in technology their presence here is only detectable to us when they want it to be.

Where does truth lie? Time may tell, but in the interim there is a lot of data to support Jim Marrs' conclusions. He ties in the crop circles, cattle mutilations, and other such anomalies. If you've read much about those you know that we have no way to duplicate them with our current technology. And the more facts you get, the stranger these things are.

Dried Brains

You probably missed the PBS show on the brain. I taped it and watched it at my convenience while eating breakfast. One thing they mentioned was that our brains tend to shrink as we get older. They didn't know why. Bet I do.

The rest of you are a lot like me in that you've been dehydrating your body for umpteen years. Sure, you've heard about the body being 90% water and you may even have heard that the brain is more like 95% water, but that hasn't made any dent in your inability to put two and two together. If your body is 90% water, shouldn't you be putting in nine times more water than food? Which may tie in loosely with the news flash from scientists that our bodies need at least eight glasses of water a day. That's a gallon.

So we go on for years gradually dehydrating our bodies. And brains. Our cells gradually shrink, which in no way is healthy for them. Ditto the cells in our brains.

The moral is: drink more like 12 glasses of water a day so your cells can gradually rehydrate themselves. They'll work better. Also, your immune system will tend not to be so depressed and it'll be able to fight off the stuff that's "going around."

One more thing. Please distill your water so your body won't have to deal with chlorine, fluorides, lead, dioxin, and the other great stuff our city or town water supplies

provide along with the water. At 50¢ a gallon for distilled water, maybe it's time to buy a still.

Sure, your body can limp along with you dehydrating it — with you dumping poisons into it — and malnourishing it — but eventually you're going to croak, probably after a long, expensive, painful illness. It's your choice.

Another Drug Scam

If you are careless enough in maintaining your body to get sick, the drug industry is waiting for you in ever more lucrative ways. Not only do they essentially control the AMA and our doctors, our hospitals, the FDA, WHO, NIH, and on through the alphabet; now they've got a new wrinkle to get your bucks.

The insurance companies own the HMOs, which work in hand with the drug companies. Pharmaceutical Benefit Management (PBM) companies were set up to control the cost of prescription drugs for HMOs. The drug companies quickly figured out that if they bought the PBMs they could dictate that doctors prescribe *their* drugs instead of those of their competitors, all under the pretense of cost management.

Eli Lilly, Merck, and SmithKline Beecham, three of the largest drug companies in the world, have bought the three largest PBM companies for $10 billion, creating a monopoly.

The PBMs have been crossing out the drugs prescribed by doctors and substituting completely different drugs, and all this without the knowledge of the doctors. Pharmacists are awarded up to $12 for every prescription the druggist "persuades" a doctor to change to that of the controlling drug company.

Make sure that if your doctor prescribes a certain drug, that that's what you get from the druggist.

Better yet, change your destructive behavior so you won't need to get involved with this whole crooked mess.

Mother Instinct

An experiment a few years ago with monkeys made it clear how important close contact between a mother and her baby are for at least the first year. In the experiment baby monkeys were separated from their mothers a few hours after birth and surrogate mothers were provided — made of heavy wire or wood, covered with soft terry cloth, with a nipple for feeding.

Later in life these monkeys clutched themselves and rocked constantly back and forth and were unable to participate in sex. The females, when they did have babies, either ignored them or abused and often killed them.

This is something mothers who want to continue going to work as soon as possible after giving birth should consider. There seems to be a very good possibility that being separated from the baby, while it is difficult for the mother, can have irreparable consequences for the baby. There's much to be said for mothers having a home business, at least for the first year, so they can be with their babies full-time.

Social Security Solution

One of the recent guests on the Art Bell show was Dolores Cannon, who claimed to have been in contact with Nostradamus. That reminded me of the *National Enquirer*. Sure.

But Dolores' story made some sense, so I called and talked with her, and she sent me copies of her first two books of the interpretations of Nostradamus' famous quatrains, as explained to her by the man himself. But let me start more at the beginning.

Dolores was regressing people to past lives, mostly as a way to help them resolve present life problems. I could understand that since that's what I found I had to do when I was doing my psychological counseling a few years back. Often, when I'd be asking the patient to go to the first time some situation had occurred they would flip into a past life experience. At first I didn't know how real these memories were, but my aim was to resolve their problems so they could live happier and more healthy lives by deconditioning the traumas, either in their present lives, or in past lives, which were affecting them in this life.

Of course my curiosity pushed me to find out more about all this, so I began to explore these past lives. I found them easily available from every patient, and available in full living color and sound. I wish now that I'd taken more time to research past lives.

Dolores one day had a person exploring a past life in which she was Dyonisis, a student of Nostradamus. Naturally she asked Dyonisis to tell her about the great man, who lived in the 1500s. After a couple of sessions gathering data on Nostradamus, he suddenly broke in to say that he was aware that Dolores was asking questions about him. After some discussion, Nostradamus said that he would like to explain each of his nearly 1000 quatrains.

The end result is a four-volume series of books, going into each of the quatrains in detail, and explaining how those referring to past history have come to pass as he predicted. But for me, his predictions of events soon to come were even more interesting.

Nostradamus had to hide his predictions in his four-line poems so as not to get burnt at the stake for witchcraft, which was the preferred treatment at the time for anyone doing any serious seering. Sear the seers. The result has been a series of translations from the old French (and Latin and Greek), all giving different interpretations of his predictions. His calling Hitler "Hister" was pretty close, considering he was looking ahead from 400 years ago. In retrospect, his predictions have been incredibly on target.

Okay, you want to know what the old guy saw for our future, right? Well, it isn't encouraging.

Like Noone in his *5/5/2000*, Nostradamus is predicting a pole shift, but in 2028. And, like Noone, he says that it will be the crust of the Earth which will shift, not the whole Earth, as René predicts in his *Last Skeptic* book. The result of this will be all sorts of tectonic plate shifting and grinding, with earthquakes, volcanoes erupting, and the polar ice quickly melting. This will bring us tsunamis and unimaginable winds.

All of our port cities around the world will be destroyed and submerged. He estimated that only about 120 million people would survive, and that the shift would wipe out about 97.6% of us.

Nostradamus produced for Dolores' contacting person a map of what the world would look like after the shift. She drew a copy of the map, as well as she could remember it. But in order to get a better-detailed map Dolores got a new person to remote-view the future under hypnosis and draw what he saw there. His map and Nostradamus' map were almost identical.

If you're experienced in hypnosis you might try getting some people to remote-view 2028 and 2029 and find out what they see coming.

Nostradamus explained that all of the world's governments would fall. Our continents would be islands, with each being a separate duchy. The US map shows that about 75% of the country will be under water, with islands in northern New England, Pennsylvania/West Virginia/Ohio, eastern Washington/Oregon, some in Wisconsin and Minnesota, a big island covering parts of Nebraska/Iowa/Missouri/Oklahoma/Kansas; another covers parts of Colorado/New Mexico/Wyoming/Arizona.

This is even worse than Scallion's (K1BWC) map of the US in 2012, which is bad enough. But at least Nostradamus puts the catastrophe 30 years away. Whew!

With all phone lines and cables kaput, we hams, if we're still around, will be the main communications source. That's unless most of our global communications shift to

Continued on page 80

NEVER SAY DIE

continued from page 79

satellites, in which case we probably won't be needed.

If I'm still around, I'll be 106 at the time, so please don't figure on depending on me for much, even though my New Hampshire farm might just be in a survival area.

Look on the bright side: In 30 years we may finally get rid of our government, which seems to be doing us a lot more harm than good these days. No more IRS, FBI, CIA, FDA, NIH, DIA, ONI, and all the other alphabetical agencies that are costing us billions and doing very little, if any, good.

In a hundred years or so new polar ice caps will lower the oceans, giving us continents instead of islands. The new poles, according to Nostradamus, will be where Russia and South America are now. That'll put South Carolina on the new equator.

Nostradamus seems to suggest that the recent French atomic testing in the Pacific has unsettled the Pacific tectonic plate, causing more and more volcanoes under the ocean to erupt. This is warming the ocean, bringing us *El Niño* and rain which is building the polar ice caps. These are off-center enough to eventually shift the poles.

The other continents apparently won't do much better — except Australia.

On the other hand, in *Mass Dreams of the Future* the catastrophe is pegged for July 1998. Happy Fourth of July!

Electrolytes

I love it when I find a book that tells me a bunch of things I'm already convinced are true. Get Gillian Martlew's *Electrolytes, the Spark of Life* for $12 and you'll see much of what I've been writing about confirmed. Keep a highlighter handy. ISBN 0-9640539-0-x; Nature's Publishing, Box 380361, Murdock FL 33938, 941-426-1929, 1994, 95p.

If you have any reservations at all about how important trace minerals are to your health, and how badly they are missing from our food supply, this book will dispel them. It explains how we've poisoned our meat with hormones, our fruit and vegetables with pesticides, and our water with chlorine, fluorides and aluminum. We eat from aluminum pots, wrap our food in aluminum foil, rub on aluminum deodorants, drink from aluminum cans, and in general do everything we can to make sure a growing percentage of us turn into memoryless veggies in a nursing home by the time we're ready to collect our Social Security checks. Aluminum is also responsible for many cases of hyperactive children.

Senate document #264 in 1936 says, "Sick soils mean sick plants, sick animals and sick people." 60 years later the situation is far worse. The US now ranks at the same level as Third World countries with respect to health. And the $1.5 trillion we spend annually has not prevented us from ranking 17th in the world in longevity, 19th in general health, and 23rd in infant survival, according to WHO figures.

We complain about kids killing kids, yet this is largely the result of really lousy nutrition, not a national moral problem. If you feed kids sugar and white flour you're going to get the same thing we see with rats fed the same diet: aggression, killing, and diminished brain development.

The University of Hawaii fed 80 pigs the standard high-sugar American diet and 68 developed heart disease.

The book is a great read; please do yourself (if not me) a favor and spring for the $12. The bottom line is that you'll see that what I've discovered in my research and have been fruitlessly preaching is valid. No, no matter how serious the consequences for you and

your family, I don't have any delusions about you stopping smoking, stopping drinking beer and coffee, cutting out sugar and white flour (which have zero nutrition, but make up for it by lousing up everything else in your system), or your eating fresh vegetables and fruits.

We're At War!

The worst part is that each of us is so isolated from reality by our educational system and media that we don't even know it. With whom are we unknowingly at war? Most of the world, but in particular, the Asian countries.

There goes Wayne exaggerating again, right? You wish.

One of the fundamental differences between American (and European) educational systems and Asian is their concentration on studying the art of war. Chinese texts on this art (*Bing-Fa*) go back beyond 1200 BC. Have you invested in (and read) Lao Tsu's *The Art of War*? The lessons his book teaches are still basic, and are being applied every day by Asians in the current war: business. "*Shang chang ru zhan chang*." That translates to "The marketplace is the battlefield."

It is no accident that America is flooded with Toyota, Honda, Mazda, Nissan, Isuzu, Mitsubishi, Yamaha, Suzuki, Sony, Toshiba, Matsushita, etc., products. It is no accident that the pants I'm wearing, my shoes, socks and shirts say "Made in China." The Mac monitor I'm using to write this says NEC (Nippon Electric Company). My Mac was made in the USA, but the engine in my laser printer was made by Canon. My FAX machine and photo copier say "Canon." My telephone says "Made in China."

What's happened?

Part of the answer is attributable to lower wages in other countries, part to the lowered cost of transportation and communications, but a large part of our failure to compete with Japan and China (and Taiwan, Singapore and Hong Kong) lies in our school system, which fares badly in comparison with virtually every other developed country in the world. Even Albania!

Not only are our college graduates unable to compete with foreign graduates in the sciences and technology, but our graduates have almost zero understanding of business, and in particular the fierce competitiveness of businesses. Knowing how a Chinese general defeated a much larger army 2500 years ago can directly affect the success of a business today. Our military, our government, and our big businesses tend to try to win by might rather than by guile, and they're losing. When I suggested we

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

1998 Collected Works

And work it was! The Never Say Die editorials for the first four months of 1998 have been reprinted in larger, more easily readable type for you doddering old-timers. 82 editorial segments, without the usual gerrymandering through the magazine, and complete with an index. 1998 Volume 1 of the Secret Guide to being Healthy, Happy, Wealthy, and Wise runs 92 pages and is available for a measily five Federal Reserve Notes, which are worth every bit of the paper they're printed on.

Gluttons for mental exercise can invest $15 in the 1997 Collected Never Say Die Works, which runs to 240 pages. Just call Chris at 603-924-0058 with your Visa or MasterCard.

Say, while you're at it, have you started on the educational program your college should have provided, but didn't, by getting Wayne's Guide to Books You're Crazy if You Don't Read? It's only $5 more. Wayne's sorted through thousands of books and reviewed the ones which will give you the best in straight dope on a wide variety of subjects. No, he/we don't sell the reviewed books. This is a reading guide, not a catalog.

There's a $3 s/h charge on any total order, so the more books you buy at one time, the better you do. Maybe it's time to get the $10 Bioelectrifier Handbook?

Wanted

Fun, easy-to-build projects for publication in 73.
For more info,
write to:
Joyce Sawtelle
73 Amateur Radio Today,
70 Route 202 North,
Peterborough NH 03458

try guile instead of brute force to win the war in Viet Nam, I couldn't get one member of Congress to pay any attention.

What I proposed was simple enough. Instead of spending $650,000 for every one of the enemy we were killing (which we did), why not bribe them? Bribery is an age-old accepted business stratagem in Asia, so why not use it? I proposed issuing the enemy soldiers coming down the Ho Chi Minh Trail a booklet which would guarantee a plot of ground for them and their family, a small hut with electricity, food to last them until their crops made them self-sufficient, and a TV set. The cost of this bribery would be minuscule compared to what we were spending to kill them, and we wouldn't have lost 58,000 Americans in the fruitless war. How much were *they* worth?

I saw in New Caledonia how the French ended centuries of tribal warfare among the natives by putting in TV stations. The natives had to stop fighting and make enough money to buy a TV set. Then, their families, goaded by ads on TV, kept them busy working so they could buy the advertised products.

In Yugoslavia I saw that people would work for years to get enough to buy a car. So why not set up a factory in Viet Nam to manufacture the most basic of cars? Like the old French Deux Cheveaux or even a go-kart.

Singapore was rescued from terrible poverty by a UN team which did a study of the raw materials and markets within easy shipping distance. They then went to Europe and got investors to build the factories and high-rise apartments for the workers to make the products. A similar study of the Viet Nam resources and nearby markets could have jump-started their economy, too.

But dissuading our military or our government from using brute force was impossible. Wrong mindset — the result of lousy educations.

Even our business schools are not teaching students what they're going to need to know to be successful in business. As an overseer of the Rensselaer School of Management I studied the curriculum carefully and found it, as a businessman and entrepreneur, pathetic. I tried to get the dean of the school to offer some of the courses I felt were badly needed by the students, but bringing about changes in the minds of a college faculty has defeated better people than I. I failed. I hired some of the school's graduates, but I found them both ill-equipped for working in a small business and unwilling to even learn. I failed there, too.

Until we make some major changes in our school system I believe that America is going to continue to lose in business. The car market is dominated by the Japanese. The music market is dominated by foreign-owned companies. Over 95% of all music sales in the world come from six companies, five of which are foreign-owned. Now the movie industry is being gradually taken over, and so it goes.

Business is war. The Japanese lost World War II, but they're making one heck of a comeback in the global business war. And we're sitting here, fat, dumb and moderately happy, while Japan and now China are eating our lunch, and looking forward to a big dinner.

That's the problem. What's the solution? I propose that some business colleges smarten up and start teaching the art of war — as well as courses which are of practical use to their graduates. I've proposed two ways of making sure that the courses are relevant — one by polling graduates as to the value of the courses they've taken and the other by having students work half time at local high-tech businesses while they are in school.

Psi-Fi

The Skeptical Enquirer has zero credibility with me (and many others) due to their pathological skepticism. Telepathy doesn't exist, nor clairvoyance, precognition, and so on, for them. And this despite endless scientific studies which have confirmed the existence of these abilities.

For instance, in the field of precognition, 309 studies reported in articles over a 50-year period were examined and the odds that the results did not show precognition came out to be one in ten million, billion, billion. That sort of ruled out chance as an explanation for the study results. But what about failed or other unpublished studies? There would have had to have been over 14,000 such studies to even the odds.

That's almost enough to get us seriously wondering about time. How can almost everyone see ahead in time if encouraged to do so? And some people with amazing accuracy?

How about our ability to influence matter? Psychokinesis? A review of 832 studies gave odds of over one trillion to one that people were able to influence the throwing of dice. And it didn't seem to matter how far they were away, or even if separated in time. Hey, what's going on here?

The only convincing explanation for a disbelief in psi is ignorance.

Serendipity

Blame reader Stowe for this. He asked me about how American Mensa got started. Well, I was there, and if you doubt it, the next time you're going to Vienna I'll put you in touch with the

chap who triggered the whole thing. He, too, has dropped out of Mensa. Well, I got bored with the New Hampshire Mensa group doing nothing. They don't even have monthly meetings with interesting speakers.

Anyway, one day, back in 1960, I read an article in *The Village Voice* about this high-IQ club in England. In college they tested what was left of my brain after my four years in the Navy and said I have a high IQ. Well, I knew *something* was wrong, and that explained it. So when I read about Mensa I sent away for a membership application. They sent that and a quiz. Soon I had a membership card. Wow!

Then, a couple months later, I got a phone call from Peter Sturgeon, asking if I'd be interested in helping him get an American Mensa group started. I was familiar with his brother Ted, a writer who'd done a book (*I Libertine*) with my friend Jean Shepherd K2ORS. I taught Jean how to water ski with my Chris Craft out on Jamaica Bay, where we used to go on picnics.

Four of us showed up for the first meeting at Peter's apartment in downtown Brooklyn. Since I had duplicating and addressing machines, I was elected as the first secretary of American Mensa. The next two meetings were at my house in Brooklyn. I served coffee and doughnuts. Well, I didn't know any better, probably like you.

I carried on as secretary until I moved to New Hampshire in 1962 and became W2NSD/1. I was the Local Secretary for NH Mensa for the next 10 years or so.

I kept all the old newsletters and meeting notices I wrote and sent out for a few years. I contacted the Mensa historian, but he wasn't interested, so I finally threw all that stuff out around 1975, when I was starting *Byte* and needed more space for people to work.

It seemed to me that Mensa offered an opportunity for high-IQ people not to just get together and revel in their fabulous intelligence, all trying to one-up the other, but to pool their mighty brains and help businesses and our government to solve problems.

Alas, with so few exceptions that I'm not aware of them, the Mensa members I've met, and I've met a lot of them, have turned out to be losers. Few have much money. Few have accomplished anything notable in life. Few have made any effort to provide their brains with information. You know, like reading something more than a few novels. It's like having a whiz of a computer and then not giving it any data with which to work. Phooey.

Success in life, I've found, has little to do with IQ, or even education. It has everything to do with motivation and the ability to stick to something. That's the secret that Ray Kroc (McDonald's®) explained in his book. And Napoleon Hill in his.

You know people who never get around to finishing anything. They leave piles of unfinished projects in their wake. In the end they have little or less to show for their having been here on Earth.

Children's Suicide

I see where they are fussing about kids committing suicide. If "they" would do some homework instead of hand-wringing, they'd know why this activity has been growing.

A couple of years ago the University of New Hampshire did a survey which showed the close correlation between childhood spanking and later suicide. That didn't surprise me. My father started early with the razor strop or the hair brush. I remember when I was about three and ate some of the doughnuts he'd made without asking. After that we never really had a father-son relationship. I knew that if I made him angry I could get hurt. Really hurt! What I didn't know was what would trigger his anger. Of course he was an alcoholic, and that helped make it a hair-trigger anger.

So I spent my teens being depressed and thinking of suicide. I know how it feels to be so depressed that you don't care if it ever gets better. The break came for me when a new kind of mental repair system came along when I was 28, one which did in minutes what psychiatry did in weeks and psychoanalysis did in years. I quit a very promising radio broadcasting job in Florida and went to a New Jersey research institute to learn more about this amazing system. We students worked on each other and in a few weeks the painful memories of my many childhood beatings had been removed and, for the first time in years, I was completely free from depression. For the first time I became aware of myself as me. I found that I'd taken refuge in being my mother as much as I could. For the first time I understood what people mean when they say that they feel a oneness with the whole world.

I could understand about plants communicating with people, and how our cells can stay in communication with each other, no matter how far separated.

A recent *Newsweek* report said that 70% of Americans believe that spanking children is okay. Well, it is if you aren't going to mind them killing themselves later on. And I'll bet you can exacerbate the problem by giving them a high-sugar diet. You know, cold cereal, boxed orange juice, coffee, Danish or toast and jam for breakfast. Burger and fries for lunch, and so on. Maybe peanut butter and jelly sandwiches in the afternoon.

If my mother had fed me that stuff I doubt I would have made it out of my teens. My best friend in high school stuck a gun in his mouth and blew his brains out. His parents believed in punishment.

I don't think you'll find any animal trainers any more who use pain or punishment in their work. They use love and positive reinforcement. Maybe you saw the PBS show about the "horse whisperer" who is able to train a wild horse to a saddle in minutes just by understanding the horse. No threats. No pain. Only positive reinforcement. The old days of Clyde Beatty, the lion and tiger "trainer" with the whip and the chair, have been replaced by Siegfried and Roy,

If you're a No-Code Tech, and you're having fun operating, tell us about it! Other No-Code Techs will enjoy reading about your adventures in ham radio—and we'll pay you for your articles. Yes, lots of nice clear photos, please. Call Joyce Sawtelle at 800-274-7373 to get a copy of "How to Write for 73 Magazine."

who sleep with their tigers. How can we go about getting this message through to the 70% of Americans who are still taking out their anger and frustration on their children by punishing them?

El Niño II

If you haven't been listening to the Art Bell show (W6OBB) you missed his recent interview with Sam Dale, a chap down in Australia who called the last *El Niño* months before any of the weather people. He called it and predicted what the results would be: heavy rains on our West Coast and tornadoes in the South and East.

Sam looks over the ocean temperatures and sees how their changing patterns have changed the worldwide weather.

Now, the really bad news. Sam says that our last *El Niño* was a baby compared with the one that's now brewing. He predicts that things will be much, much worse this next time around. For us hams this means that our emergency communications are going to be needed even more. So get your emergency gear into top working order. Get your emergency nets organized. Have your repeaters set up with emergency power. Be prepared to coordinate with your local police, fire, and other emergency services.

The rains have flooded the western states and made the Nevada desert bloom for the first time in years. The record tornadoes in the South have proven the need for amateur radio as phone systems have been wiped out and cellular phone systems too jammed to use.

Is there any connection between this warming of the Pacific Ocean and the reported calving of 75 miles of the Ross Ice Shelf in Antarctica? Well, if you take a good look at your world globe you'll see that the Ross Shelf is right next to the Pacific Ocean. That's hardly just a coincidence.

The ice shelf breaking off and melting won't raise the ocean levels because it was floating anyway, but once it's gone we could start seeing the flow of the Antarctic glaciers into the warm Pacific Ocean and that *will* raise the sea level. Oops, there goes New York, London, Tokyo, and a bunch of other ocean port cities. Hey, I'm going to be able to charge a premium for survival lots on my farm, which is at 1000 feet, for refugee New Yorkers and Bostonians.

So, mind the Boy Scouts' motto, and start making plans, at least for the soon-coming weather changes.

Antarctic Rocks

René mentioned in his book that the 800 pounds of rocks supposedly brought back from the moon were actually from Antarctica. Thus I was interested when I got a letter from a reader who said he'd shipped 800 pounds of Antarctic rocks back to NASA at about that time.

On the Art Bell radio show a few nights ago I was discussing my disbelief that our astronauts actually went to the moon and I mentioned the rock coincidence. Art couldn't believe that there could possibly be a coverup of that magnitude. Just not possible. They couldn't lie to us about something as big as that! He asked if I'd put him in touch with the guy who'd sent the rocks back. I said sure, but wondered if I could find the letter. No, I'm not perfectly organized.

A little later a chap called into the show and said that he was the one who had shipped the rocks from Antarctica to NASA! I love serendipity like that.

The last time I was on Art's show I mentioned that the mercury from amalgam fillings was poisonous and accounted for a high percentage of multiple sclerosis victims. Art wouldn't believe me. His dentist had assured him that amalgam fillings are perfectly safe.

Soon after, two different dentists called in and backed me up! Art sure has a huge listener group.

I really enjoy getting on with Art (W6OBB) and talking ham radio. Plus I naturally discuss cold fusion, health, the moon hoax, how anyone can make all the money they want, and a bunch of the other things I write about in my editorials.

Checking the Mail

Another interview on the Art Bell (W6OBB) show in late April showered me with thousands of letters — a surprising number of them with ham calls. So *that's* where the 20m crowd is sitting out the sunspot situation.

For instance, a nice letter from Henry W3RRF mentioned meeting me at a Virginia Beach hamfest. I don't get invited to that one any more. Henry says he hasn't been active lately — not much interested in idle conversation. That's probably what's kept my hand off the power switch too.

Of course, I have a more serious problem. I really enjoy doing new things, but have little interest in doing things a second time. I had a fantastic time helping to pioneer ham RTTY back in the 1950s, and then I walked away from it. Ditto slow scan in 1960s and repeaters in the 70s. I worked over 350 countries and got DXing out of my system. I've operated from around 60 countries and find

QRH

continued from page 77

From *Amateur Radio Newsline*, via *The LCARA Patch*, February 1998, Tim Culek KQ8TC, editor.

Youngest Hams in the US?

While older hams bemoan the dearth of youthful licensees in the hobby's ranks, along come Samuel Lewis KB9RYP and Sarah Bruno KB9SEG, both of Gary, Indiana, and both just four years old. Samuel, who turned five on June 1, upgraded last spring to Tech Plus; Sarah, turning five on September 8, got her Novice ticket February 25.

Both are members of families in which both parents and all but the infant members are licensed amateurs. Sarah's parents are the Reverend Ronald Bruno Jr. KG9LY, and Pam Bruno KB9RVX. Her siblings include Ronald III KG9MH, age 15, 10-year-old Jeffrey KB9RHO, and five-year-old Joshua KB9RER, who upgraded to General in December (he said the written test was hard). Their grandfather is the Reverend Ronald Bruno Sr. KB9NWM, and their grandmother is Judith Bruno KB9QZK.

Samuel's parents are the Reverend Daryl Lewis KB9RRG, and LaDonna Lewis KB9RRK, plus siblings nine-year-old Gabriel KB9REP, who just got his General ticket, and John KB9RRF, age seven. Samuel studied several months for his ticket and said passing the code test to upgrade was difficult.

All of the youngsters attend the senior Rev. Bruno's Grace and Truth Baptist Academy in Gary, where ham radio has been a regular part of the curriculum for about a year now. The school has a ham station on site and classes run 52 weeks a year. KB9NWM says it's not uncommon for kids approaching age four to be able to read pretty well. He says the two families and other members of the church community use ham radio to stay in touch and for potential use during an emergency.

The eldest Bruno says he started out with his Tech license a couple of years ago, but decided he'd like to try HF and began learning the code. While he says the youngsters in his school readily grasp Morse code, he concedes the code was "a killer" for him. He now has his Advanced ticket.

The younger Rev. Bruno soon will depart for the Philippines as a missionary and plans to take ham radio along with him.

From an article by Bill Peterson N9LL in April 1998's *PARKing Ticket*, newsletter of the Plano (TX) AR Klub, James Benningfield WB5RZJ, editor.

The Dark Sucker

For many years, it has been believed that electric bulbs emit light. However, recent information has proven otherwise. Electric bulbs do not emit light; they suck up darkness. Thus, we call these bulbs "dark suckers." The Dark Sucker Theory (that electric bulbs suck up darkness) and the proven existence of dark suckers postulates that darkness has mass and is heavier than light. To prove the theory to yourself, take an energized dark sucker device (light bulb) into any dark room. Notice that there is much less darkness right next to it than there is anywhere else in the room—and the larger the dark sucker device, the greater its capacity to suck up darkness. Note that dark suckers placed in a parking lot have a much greater capacity to suck up darkness than the ones in this room. But, as it is with many great things, dark suckers don't last forever. Once they are completely filled with darkness, they lose their ability to suck in more. This is easily proved by the dark spot on a full dark sucker device.

A candle is a primitive form of dark sucker. Note that a brand new candle has a white wick, but after the first use, the wick turns black, representing the darkness it has sucked into it. If you put a pencil next to the wick of an operating candle, it will turn black. This is because it got in the path of the darkness flowing into the candle.

Portable dark suckers have also come into common usage. With these, the bulbs (being much smaller) can't handle all the darkness by themselves and must be aided by a darkness storage unit. When the darkness storage unit is full, it must be either replaced or emptied before the portable dark sucker will operate again.

Darkness has mass. When darkness goes into a dark sucker, friction from the mass generates heat. Thus, it is not wise to touch an operating dark sucker. Candles present a special problem. Since the mass must travel into a solid wick instead of through clear glass, a great amount of heat is generated. Thus, it is also not wise to touch an operating candle.

A fact not readily apparent is that darkness is heavier than light. If you were to swim just below the surface of a lake, you would see a lot of light. Now if you were to slowly swim deeper and deeper, you would notice it getting darker and darker. If you were to swim really deep, you would be in total darkness. This is because the heavier dark sinks to the bottom of the lake and the lighter light floats at the top. After all, that's why it's called "light."

Finally, we must prove that dark travels faster than light. If you were to stand in a lighted room, in front of a closed, dark closet and slowly open the closet door, what would you see? As we all have observed, you would see the light slowly enter the closet. However, since darkness travels so fast, you would be unable to see the dark leave the closet.

Now, having been properly educated, the next time you wish to refer to an electric bulb, please use its technically correct term: a dark sucker.

By Amor N2FY, from April 1998's *Harmonics*, newsletter of South Jersey RA, John Buzby W2BU, editor. 73

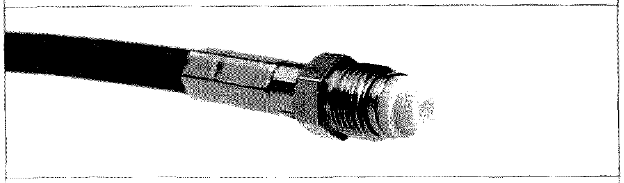
that doesn't seem to get me excited any more. Been there, done that. I had a wonderful time with Oscar VII, even managing to work Moscow one day. Done that. I was on packet early on. Done that. I had great fun working seven states on 10 GHz. I rag chewed on 75m for a year or so with W1MLX, W1KPL, and W1IF in 1946-7. W1FZJ and I used to have fun DXing on 75m. Two-meter aurora was exciting. For a while. Working 2m from a mountain top with a kilowatt and a 336-element beam was a blast for two or three years, but I don't want to do it again. I spent years at the workbench building ham gear — and loving every frustrating minute of it. So I'm sort of waiting for some new ham bug to bite. In the meanwhile I'm doing my best to get as many of you as I can to share in the fun I've had doing all of the things I've done. There isn't one of those adventures that I regret.

Arnold KH6COY enjoyed my poke at the QCWA, the society of pre-dead hams, in my April editorial. Their stance supporting the code qualifies them as one of the leading groups facing squarely backward, tenaciously holding on to the past — apparently blind to both the future and the present. How buried under the Tech pileup do we have to get before an alarm bell goes off in calcified heads?

Well, I've endeared myself to the ARRL, QCWA and the FCC — what other group can I offend? Any suggestions? 73

Number 86 on your Feedback card

NEW PRODUCTS



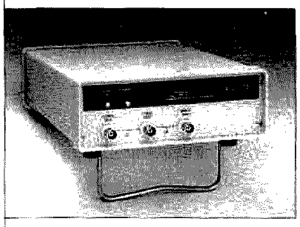
MINIMIZE INVENTORY WITH FME UNIVERSAL CONNECTORS

MAXRAD's most popular mobile antenna mounts are now available with FME universal connectors. Faster installation results because the diameter of an FME connector is only slightly greater than that of the cable it's attached to. The installer can easily pull the antenna mount's cable and factory-installed connector through a vehicle. When the cable reaches the radio or phone, the installer simply attaches the appropriate threaded adapter, which connects with the radio's antenna port, to the threaded FME universal connector.

Mini-UHF, PL-259, TNC and N-type adapters that mate with the FME universal connector are available from MAXRAD. A dealer or installation shop can minimize inventory by stocking a few antenna mounts with FME universal connectors and a variety of inexpensive adapters that fit virtually any radio or phone. Plus, when a vehicle is equipped using a MAXRAD antenna system with FME universal connector, just a new adapter is needed if the user later decides to change the brand or model of radio.

For more information, call toll-free (800) 323-9122 or write MAXRAD, 4350 Chandler Drive, Hanover Park IL 60103; check out their Web site at [http://www.maxrad.com].

SAY YOU SAW IT IN 73!

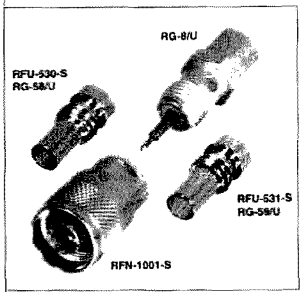


FANTASY TIME

Novatech Instruments, Inc., announces three new versions of its popular 2950AR Rubidium Frequency Standard. Dubbed the 2950AR/01, /02 and /03, these versions provide additional output frequency combinations while maintaining the $\pm$ 5×10^{-11} monthly stability of the 2950AR. The 2950AR/01 provides three 10 MHz outputs; the 2950AR/02 provides 10 MHz, 5 MHz and 100 kHz; while the 2950AR/03 provides three outputs of any customer-specified combination of 10 MHz, 5 MHz, 1 MHz, and 100 kHz.

The 2950AR/01 is $4145; 2950AR/02 is $4245 and the 2950AR/03 is $4495. Delivery may be up to eight weeks, which might give you time to explain to the XYL why your credit card balance doubled.

Check Novatech's Web site at [http://www.eskimo.com/~ntsales]. It'll give you all the data on this series, or just send money to Novatech, 17962 Midvale Avenue North, Suite 219, Seattle WA 98133.



IS "MALE UNIVERSAL" THE SAME AS "MR. UNIVERSE"?

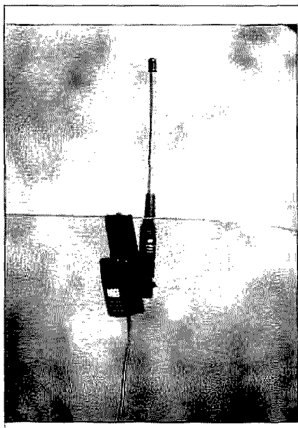
OK, maybe not. But RF Connectors has announced the availability of a newly designed N male plug which accommodates a broad range of the most popular coaxial communications cables. That's right—the RFN-1001-S N Male Universal Plug is made for 35+ different cables!

Simply insert the stripped cable into the connector body and solder the center conductor to the center contact. Screw this body/cable assembly into the N male interface housing and your job is complete!

For additional information, see your RF Connectors distributor or call (800) 233-1728.

GET YOUR JUICES RUNNING

For $3 you can get a 78-page catalog of antennas, baluns, antenna accessories, wire, coax, and connectors. This'll get you going, trying to choose among a variety of windoms and loop antennas, for HF and VHF—but this is lots more than just a catalog. Check it out. The Radio Works, Box 6159, Portsmouth VA 23703.



ROLLIN' AND RAG-CHEWIN'

Your HT and rubber ducky radiate poorly inside your car—it's a fact of life; your car roof is a shield. Clip the MFJ-310 to your window, however, and the QSO range is dramatically extended. The MFJ-310 HT window mount clip with BNC connector holds your antenna securely on the outside of the car window, where it can radiate freely. It comes with 10 feet of flexible mini-coax that can be pushed out of sight into tiny crevices in the upholstery or whatnot, and it unclips as easily as it clips on. Just put it in the glove compartment when you're done. Talk farther, longer, clearer with MFJ's new HT window mount clip for mobile operation—only $14.95—and of course it comes with MFJ's famous *No Matter What*™ one-year limited warranty.

To order or for the name of your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or check out the Web site at [http://www.mfjenterprises.com].

Number 87 on your Feedback card

PROPAGATION

Jim Gray W1XU/7
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

As you can see from the calendar, we have what might be called a "mixed bag" of conditions this month. Your *best* opportunities for DX are likely to be the 14th–19th and again the 26th–28th. The *worst* days are likely to be the 5th, 21st, 24th, 25th, and 30th. The remaining days will probably be Fair or trending, and it's on these days that your operating skills and sharp ears will pay off in DX dividends.

The month of July is notoriously poor for HF operation due to high signal absorption levels, summer thunderstorms (QRN), and the fact that we're just now beginning to notice an increase in solar flux levels.

For VHF operators, however, July could very well be an excellent month for openings on the six and two-meter bands ... and particularly near those days that are the worst for HF operation. Keep tuned for possible auroral propagation during those days.

10, 12, and 15 meter bands

Sporadic E propagation on many (G) or (F) days, with good signal strengths of short duration and quick fading. The ionized clouds drift with the high-altitude winds. Expect skip to 1,500 miles or so, and beam across the equator for possible contacts in the opposite hemisphere. These bands will close at sunset.

17 and 20 meter bands

Twenty will be the best, and sometimes 17 will be almost as good, but not as heavily occupied. If open, the higher-frequency band will provide the longest skip. Twenty will remain open after sunset and sometimes late into the evening. Seventeen will close at dark or shortly after. Possible gray-line DX along the terminator is a bonus.

30 and 40 meter bands

Excellent nighttime possibilities on evenings when QRN is low and conditions are Good. Thunderstorms between you and your target can make copy difficult if not impossible. Daytime short skip out to 1,000 miles is frequent, and nighttime skip to 2,000 miles or more will occur less regularly. Thirty meters will behave more like 20, and 40 meters will behave more like 80 on many occasions, due to the height of the reflecting layer at that time. Always check the next-higher and next-lower bands.

80 and 160 meter bands

Expect lots of QRN. You'll hear very few signals on 80 during the day, and none on 160. These bands are the nighttime bands in summer, and it pays you to keep a sharp ear open after sundown. On particularly good nights with low noise, you will find both long skip and DX on both bands. Avid DXers must be patient, however, because in summer there's almost always noise present. I'd recommend that you use the long summer days and evenings for building up better antennas for these bands, and wait until fall for conditions to improve. W1XU/7.

July 1998

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F	2 F	3 F	4 F-P
5 P	6 P-F	7 F	8 F	9 F	10 F-G	11 G-F
12 F	13 F	14 F-G	15 G	16 G	17 G	18 G
19 G-F	20 F-P	21 P	22 P-F	23 F	24 F-P	25 P-F
26 F	27 F-G	28 G-F	29 F-P	30 P	31 P-F	

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA						20	20					
ARGENTINA	20	20	20	40			20	20	15	15	15	15
AUSTRALIA		20	20	20	40	40	20					
CANAL ZONE	15	40	40	40	40	40		15	15	15	10	10
ENGLAND			40	40			20	20	20	20	20	20
HAWAII			20		40		20					
INDIA												
JAPAN						20	20					
MEXICO	15	40	40	40	40	40		15	15	15	10	10
PHILIPPINES							20					
PUERTO RICO	15	40	40	40	40	40		15	15	15	10	10
RUSSIA (C.I.S.)							20	20		20		
SOUTH AFRICA			40	40		20	20				20	
WEST COAST	20	40	40	40	40	40						20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20					20	20			
ARGENTINA	15	20	20	40			20	20		15	15	15
AUSTRALIA	15	20	20	20	40	40		20			20	
CANAL ZONE	15	20	20	20	40	40	20	20	15	15	15	10
ENGLAND	20	40					20	20		20	20	20
HAWAII	15	15	20	20	20	40	20	20				
INDIA												
JAPAN		20	20					20	20			
MEXICO	15	20	20	20	40	40	20	20	15	15	15	10
PHILIPPINES		20	20				20	20				
PUERTO RICO	15	20	20	20	40	40	20	20	15	15	15	10
RUSSIA (C.I.S.)								20			20	
SOUTH AFRICA							20				20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA		20	20						20			
ARGENTINA	15	20	20	40	40			20	20		15	15
AUSTRALIA		20	20	20	20	40	40		20		15	15
CANAL ZONE	15	15	20	20	40	40		20	20	15	15	15
ENGLAND	20							20	20			20
HAWAII	20	15	15	20	20	20	40	40	20		20	20
INDIA				20					20			
JAPAN		20	20						20			
MEXICO	15	15	20	20	40	40		20	20	15	15	15
PHILIPPINES				20					20			
PUERTO RICO	15	15	20	20	40	40		20	20	15	15	15
RUSSIA (C.I.S.)									20			
SOUTH AFRICA			40						20			
EAST COAST	20	40	40	40	40	40						20

Number 87 on your Feedback card

UPDATES

"Limited Space Antenna"

We received a note from Francis Y. Kelson HL9BK/K2KSY, regarding his article published in December 1997's *73*:

... "Sincerest apology for an oversight that has deluged my E-mail with queries in regard to the construction of the coil L1.

"On page 28, under 'Coil Construction,' the fourth line indicates that the coil has a diameter of 11/16 inches. This is wrong; it should be 7/8 inch.

"In the 'Parts List' it indicates that the coil should have a diameter of 1-1/16 inch where in fact it should be 7/8 inches in diameter. All else is correct."

Including Ham Radio Fun!

73 Amateur Radio Today

AUGUST 1998
ISSUE #455
USA $3.95
CANADA $4.95

International Edition

Build an FET Probe

Updating Old Linears

All-Band Antenna Overview

Reviews:

Kachina – The New Genera

Whiterook MK-88 Keyer

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

AUGUST 1998
ISSUE #455

73® Amateur Radio Today

Including Ham Radio Fun!

TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS

HAM RADIO FUN SECTION

On the Cover: The new Kachina 505DSP is ... well, read the review! See page 27 for everything you need to know to get hooked yourself.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine. No part of this publication August be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Barry

Amateur radio lost a treasure when Barry K7UGA died. He was always a solid supporter of ham radio. I met him when he was campaigning in New Hampshire in 1964 and we stayed friends. Now and then, when I'd get to Washington, he seemed never too busy to have lunch with me in his Senate office. We laughed over the *73* cover picture I ran during the campaign — the White House with a yagi on top of it.

Barry was, by far, the most famous American ham we've ever had, and he kept active right up until he was felled a couple of years ago by a stroke. I gather that this wiped out his memory, much like Alzheimer's, so all we really lost this year was his body.

Barry had a whopping station. I stopped off in Phoenix one time on my way to California and visited Barry and his shack. We talked for hours and had a great time. That was when Herbert Hoover Jr. was the president of the ARRL. I explained to Barry how the inner circle at ARRL HQ had been using Herb, unbeknownst to him, for their own purposes. Herb was a good friend of Barry's, so he called him and told him what I'd said. A couple days later the news was out that Herb had resigned as president of the League.

In 1985, when the Mexico City earthquake hit, Barry sent his station from his Senate office over to the Mexican Embassy, including his big yagi antenna, and had someone operate the station 24 hours a day, keeping them in touch with Luis XE1L in Mexico City. Luis later was awarded the Medal of Honor by Mexican President de la Madrid for his help during the disaster.

It's too bad that Barry didn't have a better campaign manager back in 1964. If he'd been elected I believe our country would have taken quite a different path. I believe that we'd have been out of Viet Nam in a hurry and that his basic approach of our having a minimal government would have made the America of 1998 an entirely different country. We might have much better schools, health care, and a freedom from the fear of the IRS, FDA, NSA, CIA, and other assorted alphabet government agencies. We might not even have a $6 trillion debt to pay interest on (and that doesn't count a few trillion more in unfunded government obligations).

We certainly would have been spared the enormously expensive and totally lost "war on poverty." And perhaps the lost "war on drugs." Or the Carter inflation. Or the Nixon fiasco. How different would our country be if we hadn't spent trillions on those three lost wars? It hurts a country to lose wars, both monetarily and psychologically.

Barry was in love with freedom — with liberty. He was a conservative, but he was no fan of the religious right and said that Jerry Falwell deserved "a boot right in the ass" for his proposed agenda.

By the way, I'll bet you didn't know that Barry wasn't born in the United States. Arizona didn't join the union until he was three years old.

I wish I'd taken the time to learn what I've discovered in the last year about how anyone can avoid a stroke, heart trouble, cancer, and so on. It's been a tough job sorting out all the misinformation from both the medical industry (which the media calls our health care industry), and from the alternative health field (which the medical industry calls quacks). Well, it's too late to help Barry enjoy another dozen or more years of active hamming, but maybe I can help others keep those DX pileups boiling. Probably not, since not many people seem interested.

Well, it sure would have been fun if I could have gotten on the air from K7UGA/3 at the White House 30 years ago.

Peoria in September

I'm still stewing over what subjects will be of the most interest to those of you who will be there to catch my performance. I've been wanting to do a couple of tapes that I could either sell or use as subscription premiums, and since I do a lot better with an audience than sitting in my ham shack, this would be a good opportunity.

One tape would be about the day that Khrushchev saved amateur radio. That's right, he did just that, and it's one whale of a story of how that all came about and the incredible serendipity that saved our hash — by the skin of our teeth, so to speak.

Another would be about the greatest disaster in the history of the hobby, how it happened and what the results, which we're still seeing today, have been.

My third choice is the result of some recent writing and research. I've been integrating my three books, *The Secret Guide to Health, The Secret Guide To Wealth,* and *The Secret Guide To Wisdom* into *The Secret Guide To Being Healthy, Wealthy, and Wise.* Yep, there are some shortcuts to all three goals, but they all mean making major changes in your habits and even in your understanding of how you've been brainwashed into a misunderstanding of how the world really works.

Please let me know, if you're going to be there on September 19th, when I play Peoria again, which of the three topics would be of the most interest to you. If you opt for the non-ham subject you should bring your wife and kids too — they'll benefit from it as well.

While I'm on hamfests, I haven't heard word one about how Dayton was this year. How was it? I was grateful that I didn't decide to go this year because Art Bell W6OBB interviewed me again on his radio talk show and I was suddenly up to here in mail asking for my catalog and ordering my booklets. Thousands of letters.

We discussed my growing conviction that NASA had to have faked the Moon landings, the excitement and adventure that amateur radio can provide, God, the Bioelectrifier, and a bunch of other subjects. Four hours of 'em!

My wife Sherry got involved with a video production course at Keene State College and picked as the subject for her video the Moon landing hoax. She did a lot of research, looking at every photo and video she could find on the subject. The result was a short video backing up the reasons why so many people now believe that NASA had to have faked the landings. You can get a copy

from Radio Bookshop for $15 (and $3 s/h).

This galvanized me into semi-action, madly (I was angry) typing away, explaining the two dozen or so reasons why I was converted from a believer to a skeptic. The result is a booklet, *Moondoggle*, which I think you'll enjoy. It's only $5 and it'll enable you to win any arguments from people who still believe, as Art Bell does, that golly, our government wouldn't lie to us about something as huge as that!

Say, have you ever even wondered for a moment how NASA, after a long string of failures of their rockets, suddenly pulled off six (6) successful Apollo missions to the Moon? Have you ever wondered, even a little, about the incredible serendipity that resulted in eleven (11) astronauts being killed in "accidents" a few months before the Moon trips? Did these chaps refuse to go along with the program?

While discussing conspiracies, did you hear the ex-Secret Service agent on the Art Bell show saying that our government knows all about the ETs and UFOs, and has been in communication with them for years?

Get to Peoria in September if you can and say hello before the government decides I'm too much of a troublemaker.

The Worst Poverty of All

A chap called asking for a catalog of my books. He mentioned that he had a bad heart so I suggested he might do well to read my just published book on health since it might help him live an extra 20 years or so. No, he said he didn't have any interest in living much longer. I asked him, isn't there anything you'd like to do that you haven't done? No. Isn't there any place you'd like to visit — like see the pyramids, the Taj Mahal, the lost city of Petra, or maybe climb the Great Wall of China? No, no interest. He'd visited Canada and Mexico and that's all the travel he would ever want to do.

This poverty of spirit is the worst poverty of all.

Most of us, if freed from the restraints of health and a lack of money, have all kinds of places we'd like to see and things we'd like to do. I have a bunch more countries I want to visit and a bunch more things I'd like to do. But mostly I want to do everything I can to make our country what our founders had in mind. I want to help as many people as possible to be healthy and to have more fun in life, and that includes having the money it takes to have the fun.

I had a yacht at one time and I had lots of fun with it. I had a plane and plenty of adventures as a result. I've had several Porsches and the stories that go with having had them. They were fun. But I've done those things and don't want to do them again. There are too many new things I haven't done yet. I've been on a hunting safari in Africa, had my own Arabian horses, flown around the world making 20 m SSB contacts as I went. I've operated from weird small countries and even from a desert island. I've ballooned over the African veldt, making 2 m contacts as I went.

How about you? What would you like to do if you had the time and money to do it? Okay, so what's stopping you? The only thing stopping you is the same thing that's stopping the chap I talked with on the phone — a poverty of spirit. If you think positively, good things will come your way. If you think negatively, your expectations will be rewarded. That's the way it works.

Mozart Wins More

Remarkable increases in IQ for students at the University of California at Irvine after listening to a Mozart sonata have triggered more Mozart research. In Brittany they found that cows give more milk when Mozart is played for them. It's helping Asians speed their learning of English, calming down pedestrian traffic in downtown Edmonton, Alberta, and reducing drug traffic. In Japan it's improving the yeast for making *sake* by about ten times. They measure the quality of the yeast by its density.

I've already written about the amazing difference it makes to both seeds and plants when you play classical music for them vs. rock music — and by not much of a stretch, the difference it makes with kids. Rock music is addictive, like cigarettes, and apparently not much better for people. Have you ever heard of a rock musician who didn't have drug problems? How many classical performers have such problems? I've never heard of any. When are you going to let the Mighty Mo help improve your life?

Guilty!

As I jog across the north pasture of our farm every day I feel guilty. Here I am, with my shirt off, enjoying the warm sun as I exercise, looking at the ever-changing display of wildflowers. A week ago the field was dotted with thousands of beautiful yellow dandelions. Now they're almost all gone and in their place are tens of thousands of buttercups. I can understand why artists want to try and capture such beauty.

Closer to the ground are violets and patches of wild strawberry flowers.

Early in May many of the trees and bushes were completely covered with blossoms. What a fantastic place to live.

As I look down while jogging through the knee-high grass, I see many more kinds of wildflowers. And they're always changing. Soon white and purple clover will be blooming, then violet vetch, and later the field will be filled with orange paintbrush. In the shady woods around the

Continued on page 37

QRX . . .

Hams Volunteer in Emergency... Again

Ham radio operators from across Minnesota provided a link with the outside world last spring after tornadoes struck two towns in the southern part of the state. Tornadoes flattened Comfrey, a farm community of about 500, and badly damaged the city of St. Peter, population 9000, and the home of Gustavus Adolphus College. Electricity and telephone service were knocked out by the storm on March 29. At least two people were killed.

For Minnesota Section Manager Randy "Max" Wendel NØFKU, this was more than a disaster which required the helping hand of ham radio. St. Peter was his home town, and where his parents still lived. Wendel and Minnesota SEC Gary Peterson NØZOD were among dozens of ARES members who responded.

Wendel and Peterson alerted other ARES members to be prepared to assist with communication, then headed for St. Peter. ARES members from Rochester and the nearby Mankato area were among the others who turned out. Wendel himself arrived in St. Peter after nightfall, using his ARES identification to get past state police barricades. Wendel found his parents' home damaged, but they were safe. Others, including their neighbors, found themselves suddenly homeless.

Wendel said hams already had situated themselves at key locations, including the Nicollet County Emergency Operations Center, a shelter for victims, and at a sports arena. The ARES team set up an emergency base station at Gustavus Adolphus College. While most students were out of town for spring break, 28 students remained on campus and had no contact with the outside world.

During the next day or so after the tornado struck, ham radio was the only communication out of the city and the primary means to coordinate supplies into the city from the Red Cross in Mankato to the shelters in St. Peter. The morning after the tornado, the Salvation Army arrived to distribute food. Hams provided logistical support for that effort as well. Other hams shadowed disaster assessment officials who went door to door throughout the city or handled net control duties at the EOC. Still others simply made themselves available as needed to cooperate in the recovery effort.

With typical ham ingenuity, Dave Kleindl KAØBFP scrounged enough materials to construct a temporary dipole to put a local broadcast station back on the air after its towers had been downed in the storm. With help from other hams, Kleindl also got a generator to a water tower that was still standing and reactivated the local VHF/UHF amateur and public safety repeaters.

"This event once again set a clear example of the importance of amateur radio during an emergency," Wendel said. Both he and Peterson stressed the importance of planning. Fortunately, the local government officials and agencies were aware of amateur radio as a resource. "When it comes to the unexpected, there is no time to explain who we are and why and how we can help," he added.

From April 1998's *marcKey*, newsletter of the Manteca (CA) ARC, Mike Saculla WA6FQM, editor.

You might be a real ham radio operator if:

•You know what year your FCC license expires, but you forget when to renew your driver's license.

•You have more money tied up in radios, towers, computers and antennas than you do in your children's college funds.

•You have traded your radios so often that the monthly payment on your MasterCard is about the same as your mortgage payment.

•You have climbed your tower four times this year for antenna maintenance and haven't changed the oil in the car once.

•You would rather look at the pictures in *QST* than the ones in *Playboy*.

•The clerks at Radio Shack smile when you come in.

•You burn 30 gallons of gas going to an electronics flea market to look at all the treasures and you buy a 35¢ resistor.

•Your most pressing social engagements are the contest weekends.

•All your Christmas and birthday presents come from Radio Shack.

•All the presents you buy for your wife and kids come from Radio Shack.

•You spend more time working on your radios than you do using them.

•You won't speak to your wife for two days after you've missed your turn on a DX net.

•You believe that hams who can't or won't use Morse code have a major personality defect.

•You hear a CQ at about 4 p.m. and you consider it an "afternoon delight."

•You judge a man's character not by his behavior or convictions, but rather by his ability to break through a pileup.

•You spend more than one day at HamCom or the Hamvention®.

•You actually *read* all the brochures you brought home from HamCom or the Hamvention®.

•You give your wife perfume called "On the Aire."

•You have a sign on the door of your ham shack reading "The Shack" and you get no objection from your wife.

•About once a year you clean up your shack, but never get around to cleaning your closet.

•Your radio station is cleaner than your garage.

•You got your ham station in a divorce settlement and she wound up with everything else.

•All of your coax lines and feedlines are not only the same RG part number, they are also all the same brand.

•You are talking on the radio all afternoon on Super Bowl Sunday.

•All your T-shirts are promotions for major radio brands.

•The only picture you can find of yourself is one that was taken in your ham shack.

By Bud Johnson WI5G, originally printed in *The Q-Fiver*, June 1998, Susie Scott N8CGM, editor.

GM *vs.* Microsoft

At a recent computer expo (COMDEX), Bill Gates reportedly compared the computer industry with the auto industry and stated, "If GM had kept up with technology like the computer industry has, we would all be driving 25-dollar cars that got 1,000 miles to the gallon." Recently, GM addressed this comment by releasing the statement, "Yes, but would you want your car to crash twice a day?"

If Microsoft built cars:

• Every time they repainted the lines on the road you would need to buy a new car.

• Occasionally your car would die on the freeway for no reason, and you would just accept this, restart and drive on.

• Occasionally, executing a maneuver would cause your car to stop and fail, and you would have to reinstall the engine. For some strange reason, you would accept this too.

• You could only have one person in the car at a time, unless you bought "Car95" or "CarNT." But then you would have to buy more seats.

• Macintosh would make a car that was powered by the sun, was reliable, five times as fast, twice as easy to drive, but would only run on 5% of the roads.

• The Mac car owners would get expensive Microsoft upgrades to their cars, which would make their cars run much slower.

• The oil, gas and alternator warning lights would be replaced by a single "general car default" warning light.

• New seats would force everyone to have the same size butt.

• The airbag system would say "Are you sure?" before going off.

• If you were involved in a crash, you would have no idea what happened.

—Attributed to *USECA Express* via Ann KA8IF, and lifted from a copy of the Traverse City, Michigan, Cherryland ARC newsletter, *Cherry Juice*, by KA8LDS.

Gotta Have One!

Jake the inventor is struggling through a bus station with two huge and obviously heavy suitcases when a stranger walks up to him and asks, "Have you got the time?"

Jake sighs, puts down the suitcases and glances at his wrist. "It's a quarter to six," he says.

"Hey, that's a pretty fancy watch!" exclaims the stranger.

Jake brightens a little. "Yeah, it's not bad. Check this out ..." And he shows him a time zone display—not just for every time zone in the world, but for the 86 largest metropoli. He hits a few buttons and from somewhere in the watch a voice says, "The time is fifteen forty-five," in a very western Texas accent. A few more buttons and the same voice says something in Japanese. Jake continues: "I've put in regional accents for each city." The display is unbelievably high-quality, and the voice quality is simply astounding.

The stranger is struck dumb with admiration.

"That's not all," says Jake. He pushes a few more buttons, and a tiny—but very high-resolution—map of New York City appears on the display. "The flashing dot shows our location by satellite positioning," explains Jake. "View recede ten," he says, and the display changes to show eastern New York State with true and magnetic north, and grid square references.

"I want to buy this watch!" says the stranger.

"Oh, no, it's not ready for sale yet—I'm still working out the bugs," says the inventor. "But look at this," and he demonstrates that the watch is also a very creditable little 10-meter radio transceiver with an autotuner, memory keyer, and DVK, and a sonar device that can measure distances and tower heights up to 125 meters, and a call logger with thermal paper printout for hard copy, and, most impressive of all, has the capacity for voice recordings of up to 300 standard-size books. "But I only have the US/foreign *Callbooks*, QSL bureaus and managers, and all the *Antenna Compendiums* in there so far," Jake apologizes.

"I've got to have this watch!" says the stranger.

"No, you don't understand—it's not ready!"

"I'll give you $1,000 for it!"

"Oh, no, I've already spent more than that!"

"I'll give you $5000 for it!"

"But it's just not ..."

"I'll give you $15,000 for it!" And the stranger pulls out his checkbook.

Jake stops to think. He's spent $8,500 for materials and development, and with $15,000 he could make another one and have it ready to go on the market by Dayton time. Plus, getting the

Continued on page 78

LETTERS

From the Ham Shack

Clark Crawford N7EDB. I'm so glad you have had the tenacity and audacity to continually send out the messages, year after year, to deaf ears and unseeing eyes. It is so encouraging to many of us who think and feel the same and channel our energies to the same end in different ways. Our home is a continuous school to those who will come and hear our slant on schools, medicine — or more correctly, healing arts — politics, religion, spirituality, etc., almost always very contrary to the mass media perspective. The gloom-and-doomers have been at it for thousands of years, but they affect only those who believe in them. I keep my path set on innovation, evolution, success, fun and ease. That is where I think mankind is going. You are a major player in that trend. Thanks for speaking for so many of us quieter ones.

Thanks, Clark. I need some encouragement now and then. Sigh ... Wayne.

John Lawson W3ZC. For 25 years I was a regular on our local repeater here in 3-land. That is, until a couple of years ago. Now I rarely get on. All I hear is talk about rain gauges, tomato plants, chipmunks, the attributes of various brands of potato chips, how a troubled rig needs a good smoking to get it working again, and, the most disturbing, how it doesn't matter how it works or why it works, just that it does work. This isn't ham radio. It's something else. Oh well, there always was *73 Magazine*. Until "Never Say Die" in the July issue.

I have been a regular subscriber to *73* for the last 15 years, and a sporadic subscriber before that for as long as *73* has been around. Once in a while, Wayne, you write some pretty interesting editorials. And then there are the other times. The July issue was the worst. Maybe this will bring you back down to Earth. Wayne, *73 Magazine* is an amateur radio publication. You remember ham radio, Wayne. I'm sure that most hams don't give a hoot that you read *Dilbert*. Nor do they care that you are a strong supporter of paper clips and disdain the dreaded staple. Then you run off at the mouth about your heroes Fleischmann and Pons and their fantasy, cold fusion. Do you think we hams really care to read about the attributes of drinking 12 glasses of water a day in a ham magazine? Or that we are enthralled at reading tutorials on the dark inner workings of the pharmaceutical industry, or the marvelous and grandiose solution that you originated for the Social Security "problem?" Do you really think that hams are interested in reading in a ham magazine about Nostradamus, your views on nutrition, Asian economy, or the fact that you were intimately involved with the high-IQ Mensa group? Maybe that explains why you seem to have lost your grasp on ham radio. Then there are comments on *El Niño*, Antarctic rocks, and children's suicide.

I left the *coup de grace* till last. I understand how important it is to maintain harmony in a marriage. But give us a break. Your wife's dissertation on how the world's population was deceived on Moon landings by NASA? You, a former member of Mensa, writing a long harangue on how your wife discovered that NASA never sent anybody to the Moon? All of these topics are interesting and important. But it is NOT ham radio, and *73* is supposed to be a ham magazine. Wayne, you had a lot more sense when you were poor.

Go ahead, Wayne, your turn. Take your best shot. Tell us how all of these topics are really ham radio. This ought to be good!

*So read the rest of the magazine. It's **all** ham radio. I notice that you didn't have one single positive suggestion, which doesn't surprise me. John, I've been trying to promote amateur radio as a communications medium for almost 50 years and, from what you write, there are some hams who are actually using it for that. Which you decry. Doesn't **anything** but ham radio interest you? My editorials have always been about anything I think the readers will be interested in. They were like that when I first started with* Amateur Radio Frontiers, *and then when I was the editor of* CQ *for five years, and in 73 since I started it 38 years ago. For a couple of years, when the magazine was being published by IDG, there were no W2NSD/1 editorials, and the magazine's circulation dropped to half. John, I watch the reader reply cards and note that my editorials almost always get a top vote. But one more thing: The hobby has changed since we got started in it — me in the 1930s, and you, presumably, in the 1940s. Before transistors and ICs we could build our own stuff. There were hundreds of parts houses and almost a thousand ham stores. We built using tubes on a metal chassis, mounted on 19-inch steel panels from Bud. I had shelves of resistors, capacitors, variables, switches, tube sockets, tubes, meters, and so on. And when something went wrong, the equipment went onto the workbench and I fixed it. I had a tube tester, oscilloscope, VOMs, a signal tracer, audio and RF generators, and so on. And I knew how to use 'em. Now, when my HT goes sour, what am I going to do? The same as you, John — I'm going to send it to the factory. So what do you want to hear the guys on the repeater talking about? What model rig they bought? How many years can you listen to that mindless drivel without moving on to something more interesting — like the Internet? John, I've been asking the readers for years to write about any new equipment they've bought, hoping someone would come up with something interesting I could print. I've gotten zero response. I'm encouraged that hams are talking about tomatoes, rain gauges and chipmunks ... Wayne.*

Joseph T. Gabus AB5RE. While searching back issues of *73 Amateur Radio Today* for a good Field Day antenna for QRP operation, I found Mr. Tilburg's article, "Half Square DX Antenna," May 1997, and began to gather materials for a 20-meter half-square CW antenna. I found a spool of plastic-covered AWG-14 wire, but not AWG-16, and not having a junk box full of parts, etc. I bought a plastic cutting board, about three-eighths inch thick, and cut and drilled the holes for the wire and coaxial cable. Using the formula for the smaller wire, for 14.040 MHz, I found that my wire lengths were a bit short, since the resonant frequency appeared to be about 14.090 MHz, but the SWR bridge indicated a 1:1 reading all the way down to 14.000 MHz. With the antenna supported at 20 feet, by two two-and-three-quarter-inch PVC masts, I hooked up my MFJ-9020 four-watt transceiver and gave it a try a few weeks before Field Day. I was pleased to make about 10 contacts, in many directions. On Field Day, I set up my 20-foot high PVC masts in a N–S alignment (thinking I had them east-to-west), theoretically favoring the north and south. I lengthened the horizontal antenna element about two inches, and brought the resonant frequency down to

Continued on page 86

A Silk Purse ...

Easy upgrades for Heathkit's SB-104 transceiver.

Paul Blum K9ARF
1138 Cardinal Lane
Green Bay WI 54313
[theblums@execpc.com]

As a radio amateur on a budget. I always keep my eyes open for bargains—especially "repairman specials"—that may come my way. I came across such a deal when I was offered the chance to buy Heathkit's SB-104 at a low price. The radio was in excellent shape physically, but needed tender loving care to return it to operation.

The quality of used Heathkit gear is dependent upon the person who assembled it. If that person wasn't skilled in the art of soldering, it can be a nightmare. The seller was nice enough to let me "look under the hood," and I discovered very neat, conscientious assembly work. Sold!

It wasn't long before I dug into the service manuals and had the rig back in working condition. But as I used the radio on the air, I noticed some deficiencies in its performance. The hot rodder/home-brewer in my blood kicked in, and I set about to improve things.

Introduced in the mid-seventies, the SB-104 was Heathkit's first attempt at a fully solid-state HF rig. They made some improvements along the way, which resulted in the SB-104A. The "A" version has several refinements, notably an entirely new receiver front-end board. The "A" front end uses diode doubly-balanced mixers similar to those used today. Heath offered a retro-kit to update original models to the "A" version. They also offered a kit to add crowbar overvoltage protection to the matching station power supply. Many SB-104 owners became painfully aware of the need for this protective circuit, as I have seen the factory repair stickers labeled "overvoltaged" inside.

Microphone mods

The first modification I performed was to replace the microphone jack on the front of the radio. The original is an oddball two-conductor connector which may be difficult to obtain. I replaced it with a more common four-conductor microphone jack, and used an extra conductor to provide bias for an electret mike cartridge (fed through a 12 k resistor to the 11-volt supply). You can put in any mike jack that will fit, to match whatever microphones you have around. The microphone circuit is originally designed for high impedance microphones, so I improved the input to work better with a low impedance mike. Simply replace R204 on circuit Board B with a resistor of approximately 50 k ohms.

11-volt regulator

The SB-104 operates on 13.8 volts DC, and a mobile bracket was available, so one could assume it can be run mobile. Well, it can, with two stipulations: I hope you have lots of room in your car (I don't!), and the engine had better be doing something other than idling. I attempted to operate the radio on emergency power (a car battery in my shack) and discovered it started going crazy if the voltage got lower than 12.8 volts. Looking deeper into the problem, the radio's regulated voltage is 11 volts. The 11-volt regulator couldn't maintain below 12.75 volts input, and would upset the biasing of some of the circuits, notably the various oscillators. The pass transistor couldn't turn on "hard enough" to hold the voltage steady.

I redesigned the 11-volt regulator using a P-channel power MOSFET, which has a very low turn-on resistance. On circuit Board B, remove the following components: C203, C226, C227, D207, R254, R255, and the

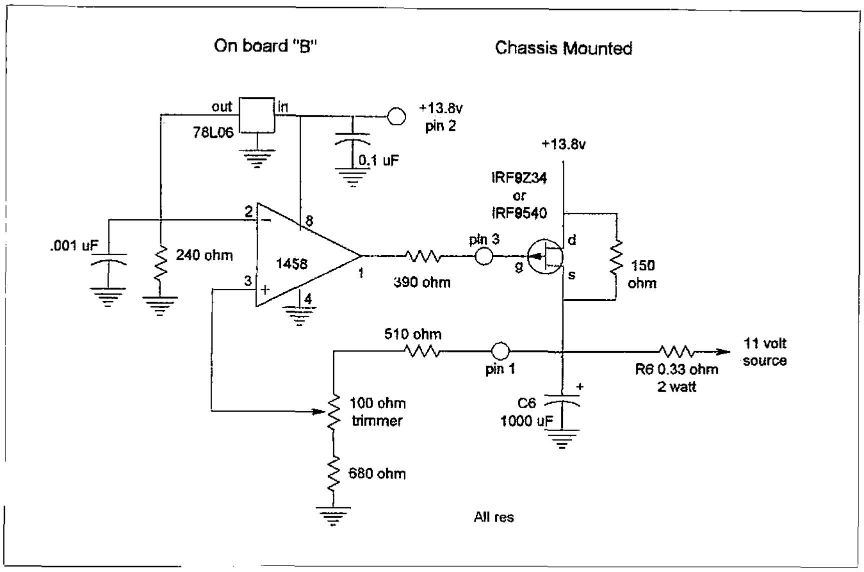


Fig. 1. 11-volt regulator, Heathkit SB-104. All resistors 1/4 W, 5% unless specified.

power transistor Q2 (mounted on the chassis). The power MOSFET transistor should mount in the same socket Q2 was removed from. Be sure to use insulating washers to prevent a short to the chassis. I constructed the remainder of the regulator circuitry (**Fig. 1**) "dead-bug" style in place of the old circuitry on Board B. The circuit consists of an op-amp referenced to a regulated six volts driving the power transistor. A lower voltage on the output results in turning on the transistor "harder." The small trimmer potentiometer should be adjusted for 11 volts output. After performing this modification, the radio remains stable down to 11.5 volts supplied.

S-meter

In the process of testing the SB-104, I had a calibrated signal generator attached to test the receiver. When I attempted to calibrate the S-meter, I found that it had less than a 20 dB range from S1 to full scale. I tried many different ways of correcting this, and found the best solution to be the simplest. On the receiver IF/audio board (Board F), the S-meter circuit is fed through a zener diode, ZD502, 4.7 V. This voltage drop is too much, delaying the action of the S-meter until well after the AGC starts functioning. Remove ZD502 and replace it with a pair of silicon switching diodes (1N914 or similar) in series. The series-connected diodes provide a 1.4-volt voltage drop, and should be installed with polarity opposite that of the zener diode. Adjust R534 on the top left corner of Board F to calibrate the S-meter. Use either a calibrated signal generator or off-the-air signals to set it to your liking. This modification greatly increases the range of the meter.

AGC "pop"

I found another design flaw I traced to Board F. When using the radio in a normal discussion with the AGC switch set to "slow," the AGC would "pop" when I unkeyed, and this effectively shut down the receiver until the AGC voltage decayed. I would miss the first few words of reply if my friend was quick on his mike. On the receiver IF/audio board (Board F), capacitor C535 controls the AGC decay. I added a few parts to hold off the charging of this capacitor momentarily when the transmitter unkeys. Just add three parts: a 2N3904 transistor, a 15 kΩ resistor, and a 15 μF tantalum capacitor. I added them dead-bug fashion along the top edge of the board adjacent to R544 (refer to **Fig. 2**).

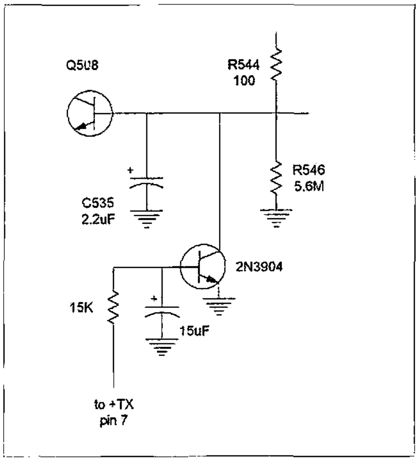


Fig. 2. "Unkey" AGC mod, Heathkit SB-104 Board F.

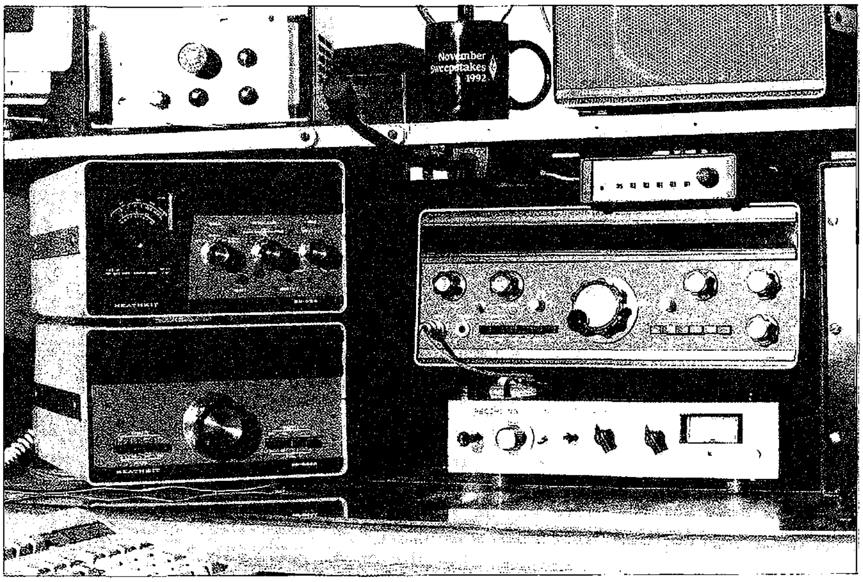


***Photo A.** Heathkits such as these once ruled the waves.*

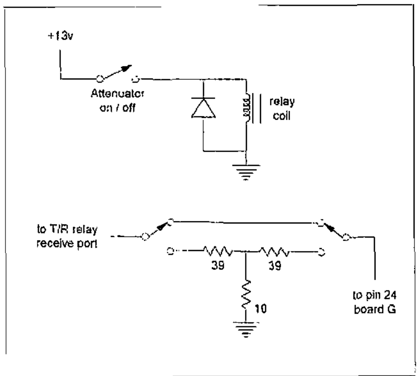


Fig 3. Receive attenuator, Heathkit SB-104.

Display ICs

In the process of my improvements, I picked up a second SB-104 (in horrible shape) as a source of parts, cheap. The frequency display on it had a couple of segments that were blank. The display digits are not LEDs, but a type of flat vacuum tube display. They require 180 volts DC for operation, so be careful when poking around behind the display! I determined the display driver IC was bad, but could not find a replacement for the DD700 chip used by Heathkit. Later I got lucky and a factory-repaired board I found had a more common IC in its place. These numbers are still currently available: SN75480N or ECG2028.

Receiver mods

The remaining modifications were done to improve the receiver's poor performance in the presence of strong signals. The true measure of a good receiver is that it can handle large signals and still hear the weak ones nearby. Such performance can be measured with modest equipment: A pair of home-brew oscillators, a hybrid combiner, step attenuator, and an AC voltmeter are used to measure receiver dynamic range (the *ARRL Handbook* explains the procedures). The SB-104 I had tested out poorly as to dynamic range. The radio was equipped with the optional noise blanker, which I discovered was a major cause of this. I didn't plan to use this radio mobile, and found it ineffective on power line noise anyway. Simply unplug the card and rewire the IF path to bypass it.

One way of improving a receiver's behavior in the presence of large signals is to attenuate them. Almost all current HF transceivers include an attenuator switch. I added a 20 dB attenuator and a small 12-volt DPDT relay to the underside of the chassis near the antenna jack (see **Fig. 3**). Put the relay inline between the T/R relay (or the optional RX antenna switch if you have one) and pin 24 of Board G. You can switch it with the now-unused NB switch. When the band is full of "big guns" (like during a contest) you can switch in the attenuator.

One determining factor of dynamic range is the quality of the filtering in the receiver. Without adequate crystal filters, a radio will exhibit "mystery S-meter syndrome" when big signals are on the band. The SB-104 has this big time—the S-meter goes up, but you don't hear anything. The nearby loud signals are getting through the crystal filter, operating the AGC, but end up outside the range of the audio amplifier, so nothing is heard. Because the AGC is operating, other weak signals you desire to hear are attenuated. Another undesired effect is hearing the opposite sideband of large signals.

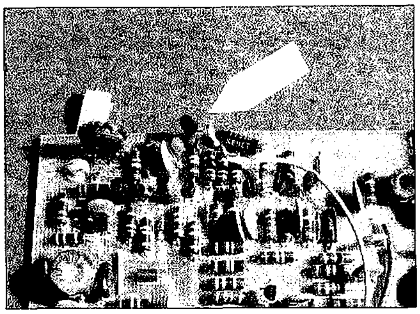


***Photo B.** A "dead-bug" cluster on Board F cures AGC "pop" (see **Fig. 2**).*

To help correct this problem, I purchased a higher-performance "Fox Tango" crystal filter to replace the stock SSB filter. These are available from International Radio, phone (541) 459-5623, or [http://www.qth.com/INRAD]. This made some improvement, but not nearly enough. This filter is the only narrow bandwidth selective element in the receiver, while most modern HF radios use two sets of filters or more.

An idea came to me as I was cleaning the workbench and found the recently removed Heath crystal filter lying there. Why couldn't I use two crystal filters like the modern radios? I designed a way to add the second filter, adding a small FET amplifier to overcome filter loss. I also used a relay to switch it inline or out. The circuit performs so well I never take it offline.

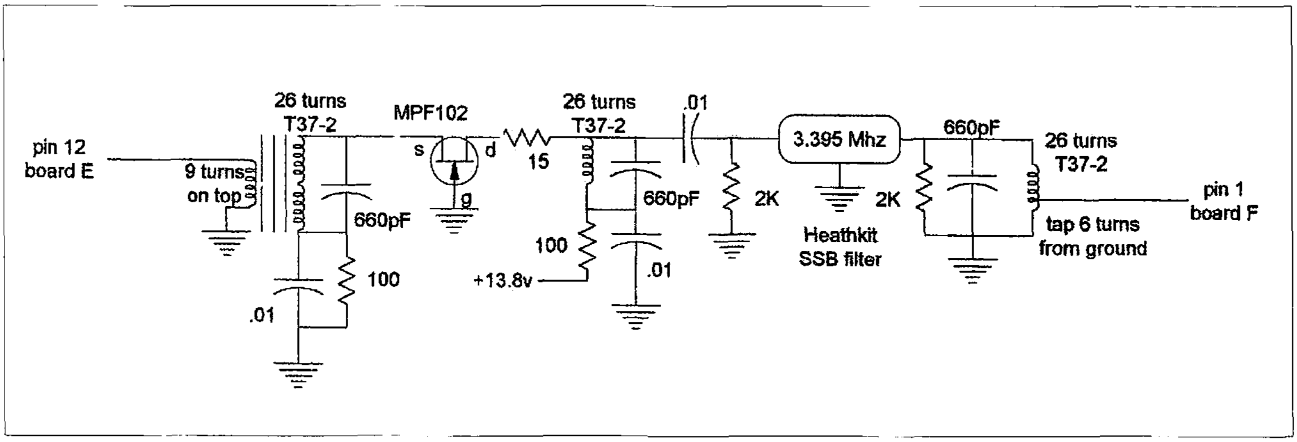


Fig. 4. SB-104PB secondary IF filter.

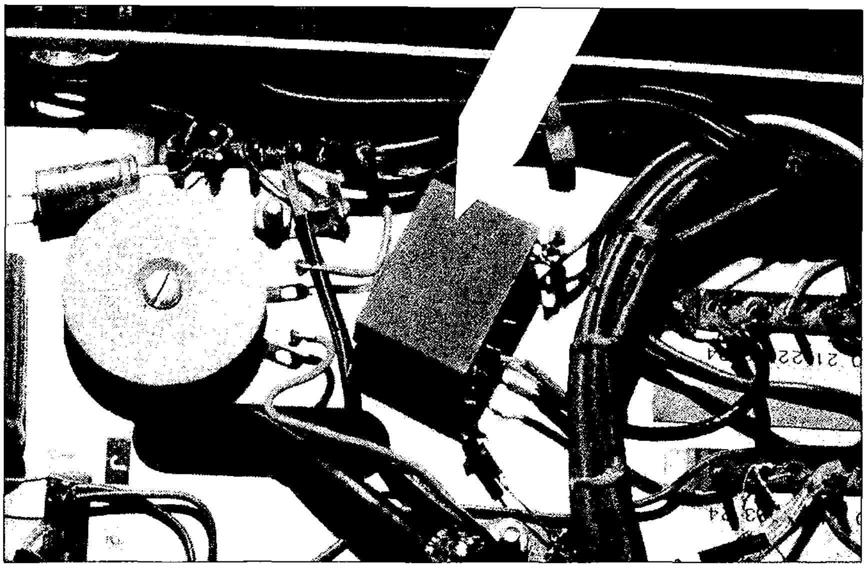


***Photo C.** The receive attenuator goes under the chassis (see **Fig. 3**).*

No more "mystery S-meter syndrome." I mounted a small piece of circuit board to the filter, and constructed the amplifier and matching circuit right on it (see **Fig. 4**). The whole assembly then mounts to the chassis above the place the noise blanker used to be. Run some small coax (RG-174) down through the chassis to the IF boards. The input to the second filter comes from Board E pin 12, and the output goes to Board F pin 1. This modification eliminates "filter blow-by" completely.

I really enjoy operating my SB-104A, and I have relabeled it the "SB-104PB" now that I have personally improved it. The radio is easy to work on, with its modular construction, and they seem to be available for low cost at hamfests and flea markets. There are other improvements to be made, and it's an easy radio to experiment with. I recommend another article about this rig by David Palmer W6PHF (*QST*, March 1982) for those who want to experiment further.

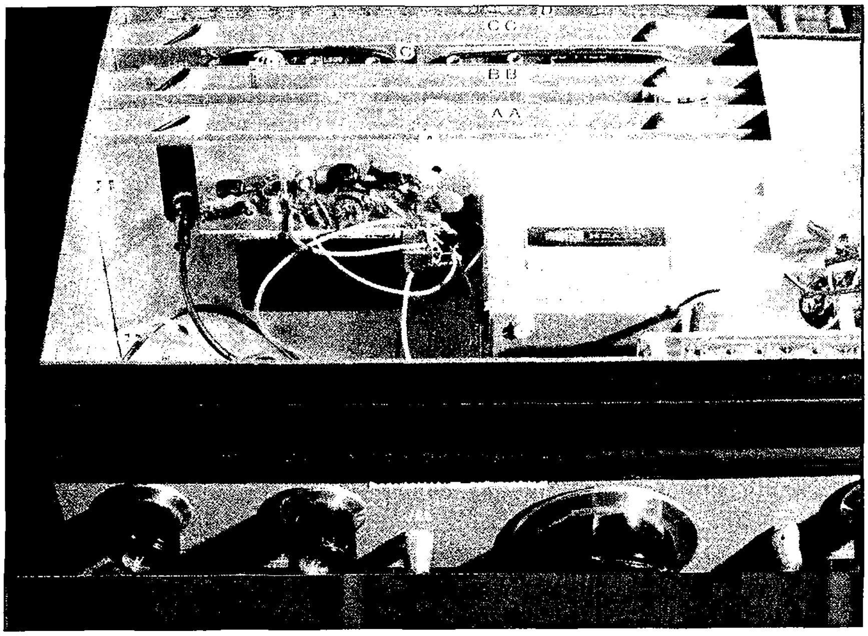


***Photo D.** A small piece of circuit board hosts the second receive filter (see **Fig. 4**).*

Power to the People!

To hams who build this tuned input network, that is ...

Ronald Lumachi W2CQM
73 Bay 26th Street
Brooklyn NY 11214-3905
[W2CQM@juno.com]

The salvaging and rebuilding of vintage amplifiers by a knowledgeable and highly motivated group of radio amateurs continues full steam ahead for reasons that remain best known to this select home-brew crowd. Their reasoning is not top secret, nor is it restricted to their eyes only; however, they are reluctant to broadcast to the world what they consider to be an ongoing good deal. It appears they would prefer to enjoy this perk for as long as possible. In a sense, their attitude can be considered a harmless conspiracy to limit the number of participants chasing a finite number of amplifier discards. What they know to be a solid fact is that the older linear decks were typically overbuilt, and that to duplicate the quality of the components today remains elusive except in the most outrageously expensive commercial products. They are equally aware that many early amplifiers currently available with reasonable prices have fallen from grace either because they are considered *old-fashioned*, because a minor component may have been smoked, or because they can't produce the super level of power perceived necessary to compete in the DX pileups.

Perhaps even more compelling is the lure of the newer generation bells-and-whistles amplifiers with their never-ending array of features, strategically unveiled over a period of time in order to create demand by making the older gear appear obsolete. These linears are continually being modified and bundled together with features that are, in fact, far in excess of practical needs. This public relations marketing strategy, coupled with Madison Avenue-type glitz, appears to be the strongest factor in separating the amateur from his savings. It's a force that's often difficult to overcome, especially when you're struggling with your better judgment to keep your hands out of your wallet.

Whatever the reasons hams use to justify the purchase of new-generation amplifiers is fine. I'll buy their old rigs all day long and do what little has to be done to bring them up to speed. It's a money-in-the-bank project even if you plan only to complete the mods and then peddle the upgraded amp for a profit. No one can fault you for turning a buck because you made a good deal.

Many hams, in order to soften the sticker shock of purchasing a new amplifier, will relegate older rigs to pasture at attractive prices. Perfectly serviceable amps are being cast aside and sold at super bargain levels.

Here's where the eagle-eyed home-brewer makes out like a bandit.

In order to learn what these astute hams already know, and to involve yourself in a fun project, take a look at the many articles describing tube retrofit projects. Power supply and RF deck upgrading are commonplace, and well-written treatises featuring Svetlana® and Eimac® tubes are yours for the asking from these sources. To catch up, simply follow the step-by-step construction directions of the tube manufacturers. Before you know it you'll be on the air with a big gun signal with that born-again ugly-duckling amplifier that nobody wanted—at minimal cost!

So what's the problem?

Many circa 1960–1980 amplifier manufacturers did not include a tuned input circuit in the typical grounded grid amplifier. Perhaps the thinking was that the losses were an acceptable tradeoff in light of the manufacturing costs and space requirements for this accessory item. The manufacturers

Photo A. A view of the tuned input module resting comfortably atop a three-hole 813 B&W LPA-1 amplifier deck cranking out 1000 + watts into the antenna. Output has been substantially improved with the input module installed. All photos by author.

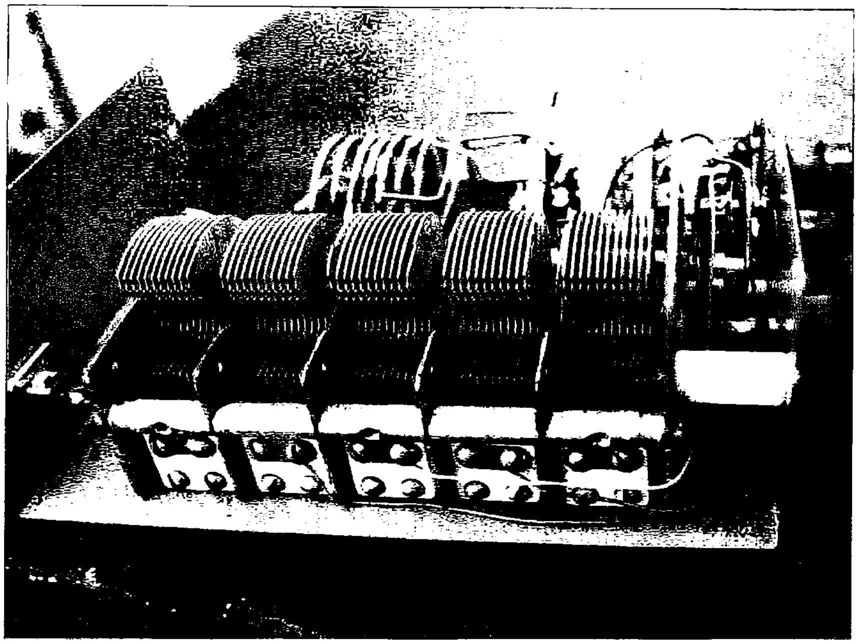


Photo B. A view of the far side of the tuned input module. Sections one and five of the air variable have been wired permanently into the circuit. The wires reaching out to sections two through four terminate at the rotary switch and have the capability of switching those sections in and out of the circuit as needed. The SO-239 is positioned on the rear wall. A short length of 58U connects this fitting to one side of the "T" adapter on the amplifier RF input.

were aware of the need for the matching input circuit, but they knew that many early transmitters had provisions to tune for an antenna mismatch. The majority of exciters had power to spare in order to drive the glow-in-the-dark finals at less than ideal conditions.

Obviously, times have changed! Linear amplifier power levels are up, tube amplification factors are out of sight, and excessive grid current, especially in the newer generation ceramic tubes, is critical and unforgiving. More important, exciter/amplifier matching must be more precise with the new-generation solid state transceiver. These digital-readout engineering gems have been programmed to reduce power automatically or will simply shut down when the impedance values are not to their liking.

Consequently, to get the best signal you can on the air, the tuned input circuit is no longer a luxury. The general feeling among amplifier designers is that the input circuit is a must. I haven't read a single amplifier construction or retrofit article that doesn't strongly recommend a tuned input circuit to ensure that the exciter signal linearity is preserved and maximum output is achieved from the new-generation, very expensive, legal-limit-plus amplifier tubes.

The problem is that retrofit circuits and components take up valuable space that's often not available in the typical amplifier deck refurbishing

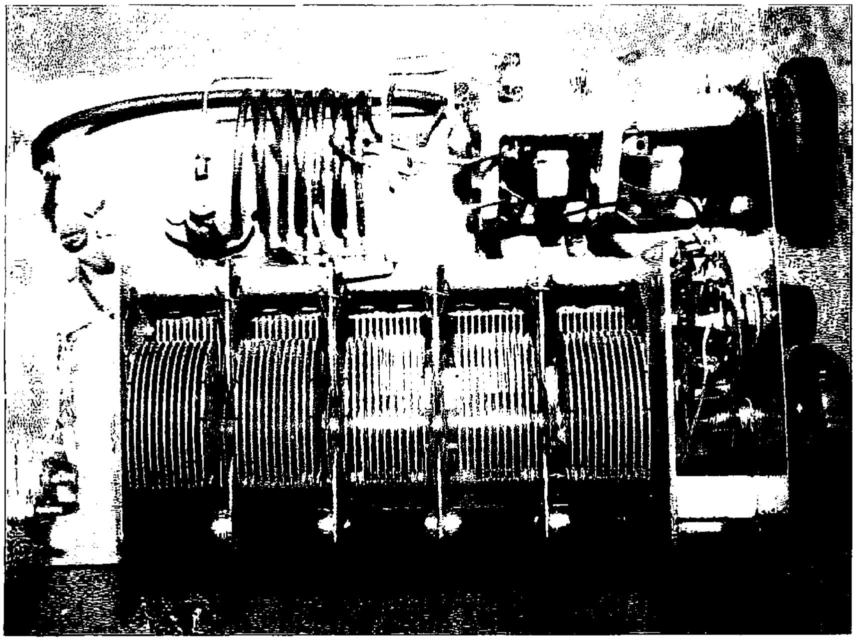


Photo C. An aerial view of the components mounted within the metal enclosure. Note how the use of the standoffs provided space to mount the three-position rotary switch. The 10, 15, and 40 m taps are visible from this perspective. The 20 m tap is soldered to the bottom end of the coil and not clearly seen. Note that all lengths of 58U have been grounded at both ends with the copper braiding.

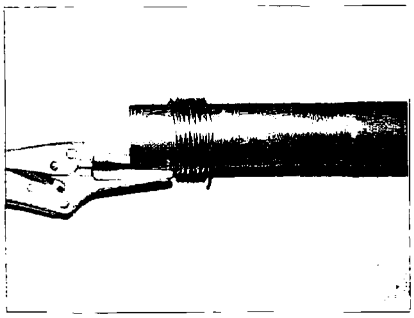


Photo D. *Close-wind a 40-inch length of #10 solid copper wire on a 1-1/2-inch OD form. I used a tailpiece from a kitchen sink drain line that measured exactly to size. The locking pliers secured one end during the winding process.*

project. Even if you were able to shoehorn in the components, linking the bandswitching with the input controls is generally impossible to accomplish without a major rebuild and extensive front panel drilling.

I faced the problem when dealing with a B&W LPA-1 amplifier rebuild (three 813s and vacuum relays). Fortunately, I managed to overcome the dilemma with a simple tuned input project (see **Photo A**) that appears to offer the best of all worlds. All the components of the matching network were mounted outboard in a self-contained enclosure I could move from amplifier to amplifier with no internal modifications. A coaxial "T" adapter and an additional short length of 58U cable were all that was needed for the hookup.

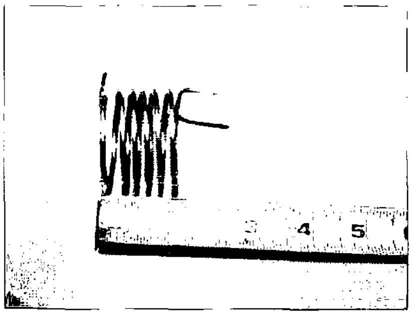


Photo E. *Uncoil the wire evenly to a length of 1-1/2 inches. Cut off any excess length but make certain to leave enough to attach solder lugs. It might be easier at his point to prepare the wire for soldering by burnishing the areas to be tapped. Keep in mind that all taps are counted from the grounded end.*

The circuit requires no power source, nor does it demand any extensive modifications to the exciter or RF deck. If that sounds like a good deal to you, check out the project details below. Then build it up, bolt it on, and broadcast away—with a signal that will do you proud. The components are easy to locate, the cost is minimal, the construction is straightforward, and the results are worth it.

The chicken or the egg?

It probably makes better sense to locate the components prior to purchasing the enclosure. There are no advantages to an overly large cabinet, so select a size that allows you to install the components in an orderly manner in the smallest space possible.

My enclosure measured 3-1/16 inches by 8-1/4 inches by 6-1/8 inches (Radio Shack #270-274) and was sufficiently large to ease the point-to-point wiring (see **Photo C**). Ideally, you'll need a broadcast-type five-section air variable totaling about 2500 pF. (A three-section with additional capacitance grafted on will work OK—Antique Radio Supply #CV264.) Locate an SP5T (nonshorting) porcelain bandswitch and an SP3T (shorting) switch (Radio Shack #275-1385) to move capacitance in and out of the circuit (depending on the band selected).

Lay out the parts and drill shaft holes to secure these components to the front panel. Don't forget to bolt the air variable to the base of the enclosure at several points for a good ground return. Using a 40-inch length of #10 AWG solid copper wire, wind a six-turn coil on a 1-1/2-inch OD form (see *Eimac Amateur Service Newsletter* #AS-10, reprint of *QST* article dated July, 1963). A short length of 1-1/4-inch brass, iron, or PVC pipe, or a closet rod will do. Trim off any excess wire and stretch it out evenly to a length of 1-1/2 inches.

Ensure an even spacing between turns (see **Photo E**). Solder ground lugs on each end of the coil. Ground the coil end closest to the bandswitch. Use a porcelain standoff to secure the far end of the coil (see **Photo F**). Tap the coil at 1-1/4 turns (10 m), 1-7/8

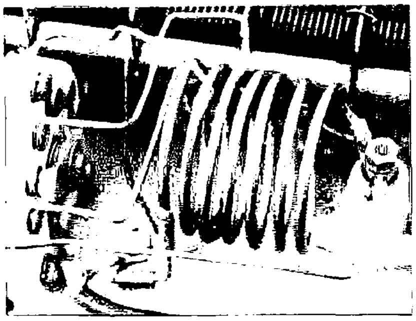


Photo F. *A close-up of the coil tapped for 10–80 m operation. Note that the 58U braid from the bandswitch is securely grounded at the coil end. The 80 m tap is taken off the porcelain standoff to the right and soldered to position five on the bandswitch.*

turns (15 m), 2-1/2 turns (20 m), and 4-1/2 turns (40 m) from the grounded end of the coil to the bandswitch using #14–16 AWG solid copper wire.

Remember that the full coil length will tune 80 m, so run a wire from the standoff to the fifth position on the switch (see **Photo G**). Two air variable sections were paralleled and permanently wired into the circuit (see **Fig. 1**). I used a small rotary shorting switch to move additional capacitance into the circuit as needed. If you prefer, replace the rotary switch with

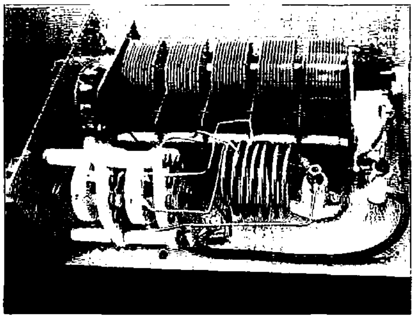


Photo G. *An overview of the parts layout. Only one pole of the porcelain junk box bandswitch is being used (Mouser #10YX025). Note that the far end of the coil is supported by the standoff insulator. The rotary selector switch adds or subtracts capacitance and is nested in front of the air variable. Two porcelain spacers were used to move the air variable back to allow room for the switch mounting. All coil taps are measured from the grounded end. The coil grounding lug is mounted a short distance from the back of the bandswitch.*

three individual SPST/SPDT toggles (RS #275-322) to accomplish the same result.

Before soldering, it may be a good idea to grid-dip the tuned circuits for resonance in order to ballpark control settings. Make certain to record the number of switches (controlling capacitance) in the circuit as well as the position of the variable capacitor knob for each band. Install an SO-239 coaxial connector to the rear of the enclosure and complete the remainder of the wiring with 58U cable. Make certain to ground both ends of the coax. To ensure a zero resistance connection between the input circuit enclosure and the RF deck, use a short length of copper braid between the circuits of both metal cabinets.

What's next?

There's not much left to do except to install the input device. Connect a coaxial "T" adapter (RS #278-198) to the RF input on the rear of the amplifier deck. Run a short length of cable from the exciter to one leg of the "T" and a second length of cable from this fitting to the input tune module. Set up your equipment (including bandswitch positions) and tune all the controls plus the air variable on the input module for maximum wattmeter output.

That's about it, except for an experiment you might find interesting. Tune for maximum amplifier output without the module in the circuit, and then repeat the process with the unit installed. You'll know immediately if the additional input tune device was worth your expenditure of time. Don't hesitate to let me know how you made out.

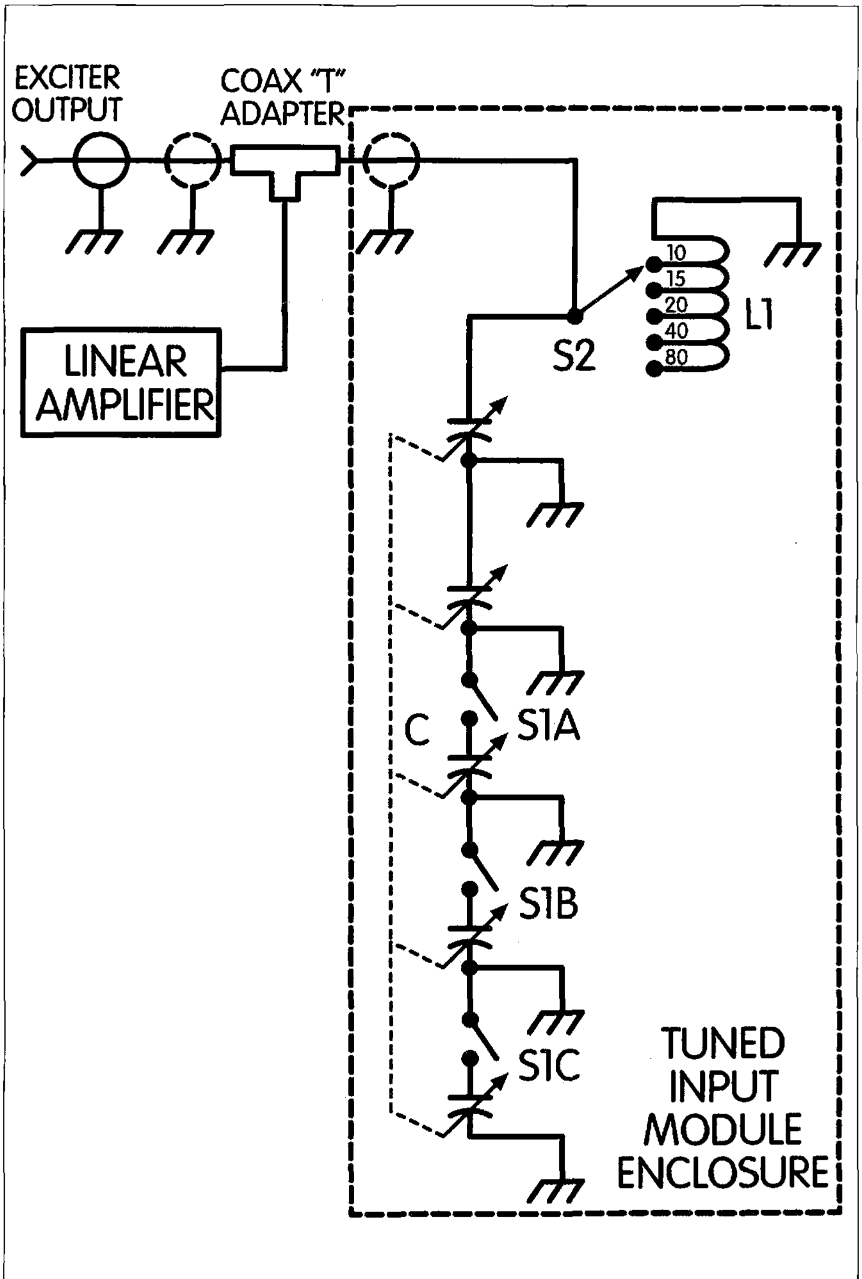


Fig. 1. Tuned input module enclosure. C1: 5-section air variable. L1: 6 turns of #10 wire 1-1/2 inches long (wound on 1-1/2-inch OD form), tapped from ground end at 1-1/4, 1-7/8, 2-1/2, 4-1/8, and 6 turns. S1: SP3T (shorting). S2: SP5T (nonshorting).

Sources of supply

Mouser Electronics
2401 Highway 287 N.
Mansfield TX 76063-4827
(800) 346-6873

Antique Electronic Supply
6221 S. Maple Avenue
Tempe AZ 85283
(800) 706-6789

Secrets of Deviant Behavior

Measuring FM deviation need not be a mystery.

Hugh Wells W6WTU
411 18th Street
Manhattan Beach CA 90266-4025

For the average ham using FM equipment, deviation is just another mystery of communications. Although instruments that measure deviation are available in repair shops, they are not readily available to the majority of ham operators. Nonetheless, making deviation measurements *is* within the reach of a ham who has access to an FM radio or scanner.

Measuring the deviation of an FM transmitter is simply a matter of determining how far the RF carrier shifts during modulation peaks and displaying the results. There have been many techniques or methods developed for measuring deviation. Perhaps the three simplest methods use:

1) A narrow bandwidth spectrum analyzer;

2) A narrow passband CW or SSB receiver;

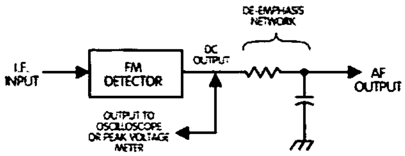


Fig. 1. Connecting a deviation indicator to a receiver's FM detector.

3) An oscilloscope attached to the DC output of a receiver's FM detector.

Each of the pieces of gear mentioned above requires a calibration technique to make it effective as a measurement instrument. But before describing the calibration process, let's discuss briefly the three methods.

1) A spectrum analyzer having a narrow passband (narrow dispersion) is capable of separating the carrier and sideband elements in the complex signal produced by an FM transmitter. Of concern is the ability to separate the carrier from the sidebands and detect it, and to observe when it passes through a null for a given amount of deviation.

2) A CW and SSB receiver having a narrow passband and capable of tuning to the output of an FM transmitter can also be used for detecting the carrier null. As an alternative, when the receiver cannot be tuned to the transmitter's output, it may be tuned to one of the transmitter's multiplier frequencies—but the deviation measured will have to be multiplied by the remaining multiplier factor to obtain the actual output deviation.

To detect the carrier null, allow the FM carrier to beat against the receiver's BFO and note the signal loss as the carrier passes into a null. When using the audible beat for detecting a carrier null, you can be easily distracted by the multiple beat notes present. Beat notes produced by the sidebands will be higher in frequency and at a relatively higher amplitude. To reduce the distraction and remain focused on the carrier as it approaches a null, it is desirable to select an easily identifiable beat note of, say, 400 Hz. A low pass audio filter connected into the receiver's audio output will assist the process by attenuating the higher frequency beat notes produced by the sidebands.

3) Connecting an oscilloscope to the DC output of the detector of an FM receiver, as shown in **Fig. 1**, is by far the easiest method to implement for measurement of deviation. The oscilloscope may be either AC- or DC-coupled to the detector, but the DC-coupled scope is easier to calibrate (as will be discussed in a moment). The scope displays the instantaneous carrier deviation of the transmitter. With the trace centered on the screen, the vertical deflection from center can be calibrated in deviation. The horizontal sweep rate and width of the scope is adjusted for comfortable viewing as only the vertical component is of concern.

Calibration of the scope can be performed by two methods. For both the AC- and DC-coupled scope, the carrier null technique may be used to establish scale calibration points for various deviation amounts. However, when a DC-coupled scope is connected, the following calibration method is used.

With the advent of synthesized radios, dial-up frequency shift calibration became very easy. Calibration is obtained by setting up a separate synthesized transmitter operating on the same frequency as the receiver to be calibrated and offsetting the transmitter (or receiver) by ±5 kHz. Deviation is indicated by marking off the scope's screen at +5 kHz and -5 kHz. Assuming a linear detection curve, the scale may be divided down to 1 kHz or 2 kHz increments. Linearity of the detection curve will be obvious by comparing the + and - offset difference in scale deflection. Nonsymmetrical deviation from a transmitter will be readily apparent once the scale is calibrated.

Carrier null calibration technique

Perhaps the oldest and most used method, because of its accuracy and repeatability for determining deviation, is the carrier null technique. Detecting the carrier null involves observing when the FM carrier passes through a null or zero point using either method 1 or 2 as described above. The carrier will predictably pass through

Audio Frequency Values

Deviation (in kHz)	1st null (in Hz)	2nd null (in Hz)
1	415.8	181.2
2	831.6	362.3
3	1247.4	543.5
4	1663.2	724.6
5	2079.0	905.8
6	2494.8	1086.9
7	2910.6	1268.1

Table 1. Audio frequency values required to create a specific deviation using either the first or second null.

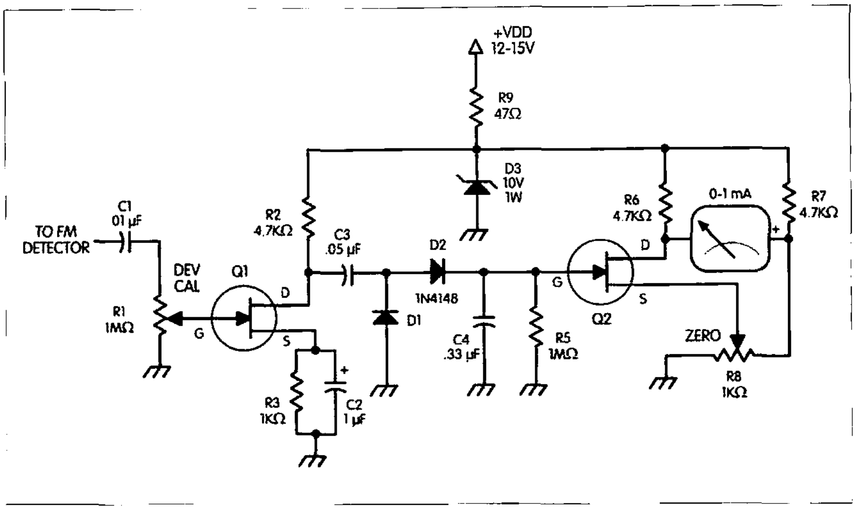


Fig. 2. Peak-reading voltmeter used for monitoring FM deviation.

a null at several modulation index (M) points such as M = 2.405 and 5.52.

Calibration of deviation involves applying a single sine wave audio voltage of known frequency to the transmitter and increasing the audio amplitude until the carrier reaches a null. The null is detected as a loss of beat note in the CW or SSB receiver, or as a carrier loss by a spectrum analyzer. If the modulating audio frequency used is 1 kHz, then at the first null the deviation would be 2.405 kHz and at the second, 5.52 kHz. It is usually easier to detect the first null than the second when listening to beat notes.

For calibration purposes, it is preferable to identify specific or whole number deviation points instead of using a number like 2.405 kHz. Therefore, specific frequencies can be calculated using the following equations:

$$Fdev = AF \times M(at\ null)$$

$$AF = \frac{Fdev}{M(at\ null)}$$

The first equation finds the frequency of deviation when the audio frequency is known and the second finds the audio frequency when the deviation is known. In the equations, the M value is selected to match the desired null, e.g., 2.405, 5.52. To simplify things, **Table 1** provides a listing of various audio frequencies for specific values of deviation as a function of the first and second null. Generally speaking, for most ham applications, calibrating a single deviation point is usually sufficient. That single point would be the maximum deviation value desired for that application—perhaps 5 kHz.

An FM receiver used as a deviation meter

Most all FM receivers, including some scanners, can be utilized to display deviation; it is simply a matter of connecting a metering circuit, as shown in **Fig. 1**, to the DC output of the FM detector ahead of the de-emphasis network. The metering circuit can be a peak-reading AC voltmeter or an oscilloscope. If the scope has a DC input, the deviation can be determined simply by offsetting a received carrier by ±5 kHz and marking the screen accordingly. For rough calibration and casual deviation comparisons, the receiver with its meter or scope attached may be tuned to either a ham or commercial repeater. Deviation calibration of repeaters is usually performed using calibrated test equipment and can be assumed to be close to 5 kHz.

As a calibration transfer standard, a DC scope and an FM receiver can be calibrated by the ±5 kHz offset method and then used to adjust the deviation of a transmitter to 5 kHz which is being modulated by a single tone. The calibrated transmitter can then be used to calibrate a peak-reading voltmeter, circumventing the carrier null calibration technique.

Peak-reading AC voltmeter

The circuit shown in **Fig. 2** will detect and display the peak deviation on a meter. The instantaneous pointer movement follows the modulation with the deviation value indicated at the peak pointer excursion. However, a more accurate peak can be determined when the transmitter is modulated with a constant amplitude single frequency tone rather than with voice peaks.

To maintain simplicity, the meter circuit was designed to operate from a single polarity voltage source with as few parts as possible. Meter response linearity was given up as a trade-off for simplicity, as only the peak deviation point is needed. It is interesting to note that the circuit exhibits reasonable linearity in the upper 90% of the scale.

When voice is received, the meter will function as a pseudo-VU meter, with the pointer flying back and forth. The rate of pointer swing is dampened by the time constant as determined by capacitor C4 and resistor R5. The dampened swing, however, does not deter calibration from a single tone, but does prevent accurate calibration from voice peaks.

Because most FM receiver detectors provide more than a one-volt output when the IF limiter is saturated, the voltmeter input sensitivity was considered adequate at approximately 500 mV for full-scale deflection. A pot was included for setting the desired maximum deviation point on the scale. The input sensitivity of the circuit is affected by the value of the supply voltage, and regulation of V_{dd} is necessary. Input signal value—voltage versus meter scale—was plotted for various values of V_{dd} to determine the best circuit linearity. A V_{dd} value ranging between 9.7 and 10.2 volts was ideal, with a 10-volt zener being preferred. A one-watt zener was chosen to gain V_{dd} stability.

The voltage detector, which is a fairly high impedance circuit, consists of

Continued on page 78

Only One Antenna

All about multibands.

Bill Clarke W2BLC
764 Alta-Voor Road
Altamont NY 12009
[W2BLC@bigfoot.com]

The antenna dilemma for many hams is very real. Not everyone has the physical space or unlimited resources to install multiple HF antennas and towers. It is also safe to say that many hams live where at least some restrictions apply to antenna structures—and not every ham *wants* to put up towers and beams and separate antennas for each band. The reasons may vary from esthetics to finances.

All that a ham station really requires for communications is an efficient antenna for the chosen band(s) of operation and a rig to put a signal into the antenna(s). For most HF operators, this means an antenna capable of working all the bands, usually 80 through 10 meters. However, the antenna can include 160 meters if there is the physical space available.

The single-wire multiband antenna answer

There are several choices of single-wire antennas available that will operate on more than one band. The term single-wire means that only one wire is used in the antenna's construction (a dipole is a single-wire antenna). Each of the following antennas is a well-designed multiband antenna, constructed of a single-wire element antenna. Some examples can provide gain over a simple dipole on the higher bands.

Single-wire antennas are not obtrusive, are easily installed, and are as close to "sure-fire" as you can get. Cost covers the range from a few dollars for a home-brew wire antenna built with "junk-box" parts to a little over a hundred dollars for a factory-built trap antenna. The single drawback for using these antennas is the need for a tuner, particularly on the lower bands.

An adequate antenna tuner that is capable of handling the output power of any modern HF transceiver can be purchased new for under $100. For kilowatt power levels, the prices start at a little over $250. My personal favorite is the MFJ Differential-T tuner, which is capable of handling my linear amplifier and any antenna I have ever connected to it.

Many of the newer solid state HF transceivers have built-in antenna tuners that do the antenna matching automatically. Should you be fortunate enough to own such a rig, you only need to connect the feedline from a multiband antenna to work the world.

The Carolina Windoms

The original Windom antenna was designed by W8GZ in 1928 as a half-wave antenna, off-center fed with a single wire (this was BC: before coax). Today's Carolina Windom retains the half-wave off-center fed primary element; however, it is now fed with coax and incorporates a vertical radiating element (which is part of the feedline). They are well-constructed antennas designed to be installed and used for many years with no further attention.

The Carolina Windoms are available in three sizes (for various band combinations):

1. Carolina Windom 160 (160–10 meters), 252 feet long.
2. Carolina Windom 80 (80–10 meters), 133 feet long.
3. Carolina Windom /2 (40–10 meters), 66 feet long.

Installation can be either horizontal or as an inverted vee (see **Fig. 1**).

Due to the half-wavelength size of the horizontal element, the Carolina Windom antenna gives gain over a dipole on all bands above the primary

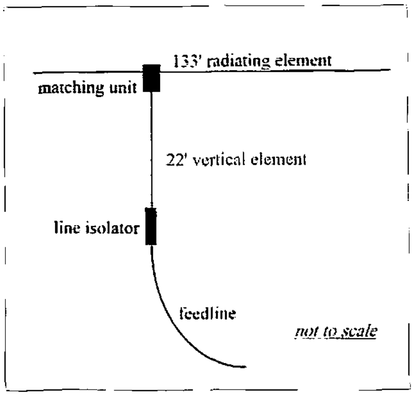


Fig. 1. Carolina Windom. All figures not to scale.

design band. The primary design band is the lowest operating band (40, 80, or 160 meters). The antenna should be mounted 30 or more feet above the ground.

An offshoot of the Carolina Windom is the Carolina beam, which is essentially a bent version of a Carolina Windom taking only 82 feet of horizontal space for installation. The Carolina beam is designed for improved performance in the DX bands, but performs well on the 80 and 40 meter bands (see **Fig. 2**).

Carolina series antennas are available from The Radio Works.

The G5RV antenna

The G5RV antenna is a small single-wire antenna, fed with coax line, and only 102 feet from end to end. It works on the 80–10 meter bands. The antenna is centerfed with a 31-foot section of 450-ohm ladderline, which is

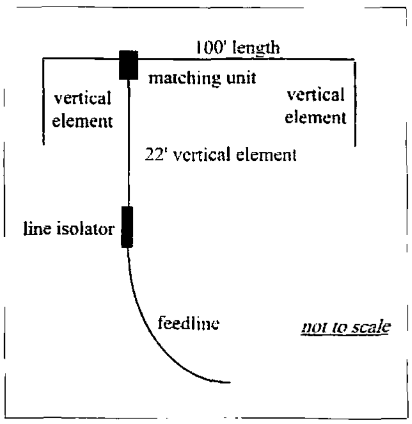


Fig. 2. Carolina beam.

used as a matching section, and is terminated with a coax feedline. The feedline runs from the matching section to the transmitter (any length). The antenna must be mounted 35 or more feet above the ground, due to the ladderline matching section (see **Fig. 3**).

The G5RV antenna provides gain over a dipole on all bands above 80 meters and functions well with the auto tuners found on many of the newer HF rigs. It can be installed as a horizontal or inverted vee antenna.

Constructed G5RV antennas by Van Gorden Engineering are available through many amateur radio equipment outlets. The Radio Works also produces a G5RV antenna. As a homebrew project, the G5RV is a popular antenna, with parts readily available from ham stores and the suppliers listed at the end of this article.

Trap antennas

Trap multiband antennas have been around for many years. Due to the weight of the traps used, they tend to be somewhat heavier than the wire-only antennas previously mentioned. Trap-based antennas function as dipoles for each band and provide no gain as the operating frequency increases.

The theory of a trap antenna is the simple isolation of the used portion of the radiating element, based upon frequency, from the overall antenna. In other words, each band's traps isolate part of the antenna into a simple dipole for a single band (see **Fig. 4**).

Some trap antennas use a single pair of traps for all-band coverage, while others use several traps. All trap antennas are physically shorter than a full-size antenna for a comparable single band. It is normal to need a tuner on the lower bands for full frequency coverage. Trap antennas can be installed as horizontal or inverted vee antennas.

Manufactured trap antennas are available from SPI-RO Manufacturing, Inc. Individual sets of traps are available from many ham radio stores for those wanting to build their own trap antennas.

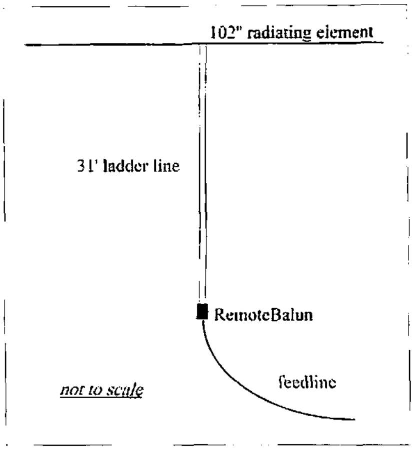


Fig. 3. G5RV.

Multiband center feed

A very easy antenna to install, this one provides gain on bands above 80 meters and is perfect for the homebrewer. It's a simple half-wave dipole (cut for the lowest frequency of planned use) fed at the center point with 450-ohm ladderline. Generally, the antenna is about 135 feet in overall length (see **Fig. 5**). The antenna can be designed for 40 meters and up by using an overall length of 67 feet.

Many hams are scared away by the ladderline. However, there is a very simple solution to the "ladderline problem"—use a RemoteBalun™ from The Radio Works. This device acts as an interface between ladderline and coax, allowing easy antenna cable entry into the shack and simple tuner usage.

This simple antenna has been a standard for hams all over the world. Like the Carolina Windom, G5RV,

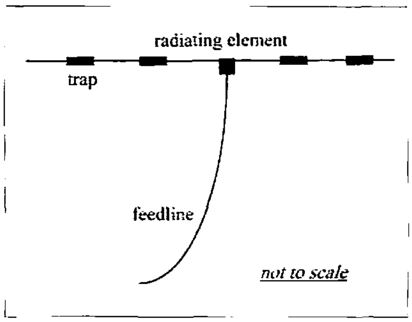


Fig. 4. Trap dipole. Trap antenna length is a product of the number and types of traps used and the bands designed for.

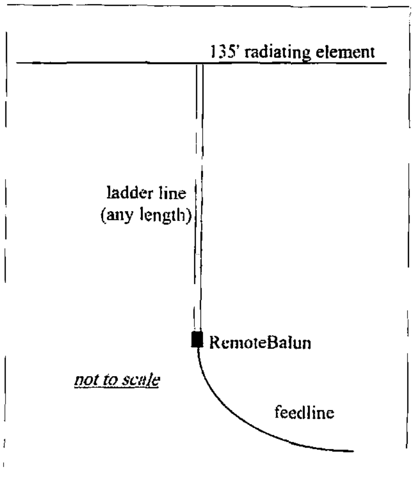


Fig. 5. Multiband dipole.

and trap antenna, it can be installed as a horizontal or inverted vee.

Double extended zepp

Similar in appearance to the previous antenna is the double extended zepp (see **Fig. 6**). Its advantage is a nearly 3 dB gain over a simple half-wave antenna on the band of design—and that improves as you move up through the bands. The antenna's major drawback is its sheer size. It is an excellent candidate for home-brew.

The double extended zepp is 1.28 wavelengths long at the design frequency. The original versions called for parallel feeders from the center of the antenna to the shack. The modern version uses a 4:1 balun at the end of a measured length of ladderline and coax to the shack.

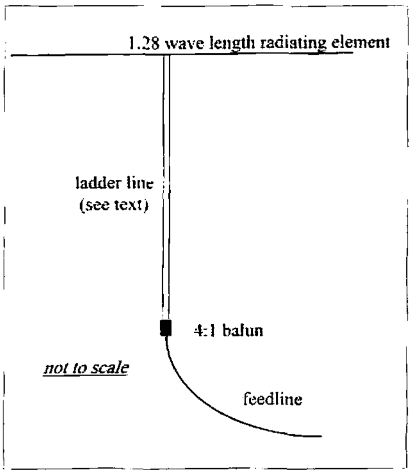


Fig. 6. Double extended zepp.

An 80-meter version would be 343 feet long overall, with the ladderline 29.5 feet long before the 4:1 balun. A 40-meter version would be 171 feet and 14.7 feet, respectively. There is no reason that ladderline could not be used from the feed point to the shack, as with the multiband centerfed antenna.

The double extended zepp can be installed horizontally or as an inverted vee.

Endfed zepp

An often overlooked home-brew multiband antenna is the endfed zepp (see **Fig. 7**). Based on an antenna originally used on the zeppelin airships, it is a capable half-wave design providing multiband use and gain on frequencies above that of design. Careful planning must be used with this antenna to prevent RF from entering the shack via the feedline.

The feedline must be one-quarter wavelength and the main element a half wavelength long. Although the diagram shows the feedline leaving the main element at right angles, this is not a requirement. The feedline can be brought into the shack and connected directly to a tuner, or a RemoteBalun™ could be used.

The endfed zepp can be used on bands above that of design and provides gain over simple dipoles. End feed may allow easier antenna installation in some instances. This antenna is a home-brew project.

The dimensions for an 80-meter endfed zepp call for 450-ohm ladderline to be 67 feet long and the main element to be 134 feet long. A 40-meter version would be 67 feet and 33.5 feet, respectively.

Safety note

When installing any antenna, be aware of your surroundings. *Do not* install an antenna in such a manner that it could fall onto a power line or another's property, or onto persons. Follow good engineering practice, such as outlined in the various publications of the ARRL and required by the National Electric Code (and your local electrical safety code).

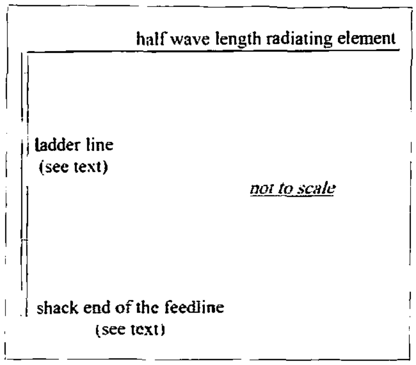


Fig. 7. Endfed zepp.

Suppliers

The following antenna suppliers sell products as indicated:

Antennas West
Box 50062
Provo UT 84605
(801) 373-8425
Constructed antennas

Davis RF Co.
P.O. Box 730
Carlisle MA 01741
(800) 328-4773
[www.davisrf.com]
Wire, feedlines, rope, insulators

The Radio Works
P.O. Box 6159
Portsmouth VA 23703
(800) 280-8327
[www.radioworks.com]
Constructed antennas, wire, feedlines, rope, insulators, RemoteBalun™

SPI-RO Manufacturing, Inc.
P.O. Box 2800
Hendersonville NC 28793
(800) 728-7594
Constructed antennas

Van Gorden Engineering
P.O. Box 21305
South Euclid OH 44121
Constructed antennas, traps, insulators

The Wireman, Inc.
261 Pittman Road
Landrum SC 29356
(800) 727-9473
[www.thewireman.com]
Wire, feedlines, rope, insulators

Cool It!

Cold facts about the hot topic of heat transfer.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

Cool it! can be good advice when a lid tunes up on the signal you're trying to copy. It's also good advice if you want your transistors to live a long and useful life. This article won't be much help for the first problem, but it will help you understand how to cool a transistor. Come to think of it, keeping your transistors alive for a while may keep you from blowing your cool.

There are several ways of having cooler transistors besides using cooler watts or making transistors with that rare-earth unobtainium. Seriously, though, cooling a transistor is a matter of getting the heat out of the junction. Heat can only be moved from a warmer place to a cooler place. You can't add cool; you can only remove heat, which is practically the same thing. In a transistor the hot place is the junction, and the cooler place is usually the ambient air. In between the hot junction and the cool ambient is the transistor's case and maybe a heat sink.

Thermal resistance R_θ impedes the flow of heat and is analogous to electrical resistance impeding the flow of current. R_θ is given in terms of degrees per watt, °C/W. The thermal resistance from junction to case is $R_{\theta JC}$, the thermal resistance from junction to ambient is $R_{\theta JA}$, and the thermal resistance from heat sink to ambient is $R_{\theta SA}$. The thermal resistance through which the heat must flow is:

$$R_\theta = R_{\theta JC} + R_{\theta CA} + R_{\theta SA}$$

In many specifications, thermal resistances are not specified. Instead, the maximum power dissipation at some case temperature, usually 25° C, is given and a derating factor that relates allowable power dissipation at other case temperatures. These two methods of specifying allowable dissipation can be reconciled, though.

The $R_{\theta CA}$ is determined by the case style; all TO-92s have the same $R_{\theta CA}$, all TO-220s have the same $R_{\theta CA}$, and all TO-3s (TO-204s) have the same $R_{\theta CA}$. The thermal resistance between the junction and case $R_{\theta JC}$ is determined primarily by the die size and internal mounting. Larger dies have a larger contact area between the die and the case and have lower $R_{\theta JC}$. Larger die also permit higher currents. For example, the IRF630 has I_D of 9 A and $R_{\theta JC}$ of 1.67° C/W, while the IRF612 has I_D of 2 A and $R_{\theta JC}$ of 6.4° C/W. Both have $R_{\theta JA}$ specified as 62.5° C/W, which implies that the $R_{\theta JC}$ is much smaller than $R_{\theta CA}$. A TO-3 (TO-204) case has an $R_{\theta JA}$ of about 30° C/W. Therefore, a particular die in a TO-204 case can dissipate about twice the power of the same die in a TO-220 case.

A moderate heat sink one inch long by one inch wide with half-inch fins has an $R_{\theta SA}$ of about 30° C/W in still air. The thermal resistance $R_{\theta JA}$ of the IRF630 in such a heat sink then is:

$$R_{\theta JA} = R_{\theta JC} + R_{\theta SA} = 1.67 + 30 \approx 32° \text{ C/W}$$

The thermal resistance $R_{\theta SA}$ can be reduced with forced-air cooling of the heat sink. When the air velocity over the heat sink is 100 feet per minute, the thermal resistance drops to between 11° and 12° C/W and the $R_{\theta JA}$ of the IRF630 on such a forced-air-cooled heat sink drops to about 14° C/W; this increases the allowable power dissipation by a factor of about five. When the air flow is increased to 400 feet per minute, the thermal resistance drops to about 6° C/W.

Forced-air cooling works by replacing the hot air next to the heat sink with cooler ambient air. The faster the air moves over the heat sink, the more quickly the heat can be carried away, and the cooler the heat sink.

The heat sink to ambient thermal resistance $R_{\theta SA}$ is dependent on its surface area as well as its thermal conductivity. Larger and heavier heat sinks have lower $R_{\theta SA}$. A copper heat sink is more effective than an aluminum one with the same dimensions.

While the surface area of the heat sink exposed to the air is the major determinant of thermal resistance, the shape of the heat sink plays a part as well. The obstruction to convection air currents flowing over the heat sink determines how quickly or easily the heated air can move away from the hot surface of the heat sink. Consequently, a heat sink would ideally be oriented with the fins vertical so the air can rise up over the fins. Also, a heat sink should be mounted in an area that doesn't trap air, that has free air movement. A heat sink mounted on a circuit board pushed against the cover will not be as effective as one with room around the board. Keep in mind that the air temperature inside a cabinet will be higher than the outside air. A 20° C rise inside a cabinet is not unusual. If the cabinet is in a 35° C (95° F) room, the internal temperature of the cabinet can easily be 55° C (131° F).

The temperature of power transistors is usually considered because you know they have the potential to get hot, but many times the temperature rise of a small transistor is overlooked, which leads to "Oh, shucks" or some such expression when you burn your fingers. Which translates into "Dummy, you should have thought about that!" Those little buggers can get hot!

Reducing the temperature rise of the case for a TO-92 is just as important as it is for a TO-220. The choice of heat sinks for the TO-92 transistors is not as broad as it is for the power transistors with TO-220 or TO-3 cases, but keeping the temperature rise within safe limits is just as important. AAVID Engineering makes a clip-on heat sink (model number 575400) for the TO-92 transistor case that has a thermal resistance $R_{\theta SA}$ of about 40° C/W. Mouser Electronics [958 N. Main, Mansfield TX 76063; (800) 346-6873] carries a broad range of AAVID heat sinks, including those for large and small transistors.

Sometimes the thermal characteristics of the small transistors in the TO-5 or TO-18 metal can or TO-92 plastic package are given in degrees Centigrade per watt and a case temperature derating factor instead of $R_{\theta JA}$. For example, the 2N3904 is specified in both terms. The thermal resistance from junction to ambient is specified as 200° C/W. Total device dissipation is also specified as 625 mW, with a case temperature of 25° C, with the dissipation derated 5 mW/°C above 25° C. Most TO-92 silicon transistors have a maximum junction operating or storage temperature of 150° C. Therefore, the maximum permitted case temperature rise above 25° C is 125° C. **Fig. 1** shows the derating curve for the 2N3904 and similar transistors. The transistor can dissipate 100% of the rated power at 25° C and zero power at 150° C. With the maximum junction temperature and power dissipation given, the thermal resistance case to ambient can be inferred:

$$R_{\theta JA} = \Delta T_c / P_D = 125°\text{ C}/0.625\text{ W} = 200°\text{ C/W}$$

where T_c is case temperature and P_D is the rated power dissipation at 25° C.

Once a heat sink has been selected, mounting the transistor to it is not the no-brainer it might appear to be. Of course, the transistor should be clamped to the heat sink to ensure intimate contact—but not too tightly. Excessive clamping pressure can distort the case of the transistor and crack the semiconductor die or break an internal connection. Mounting a TO-220 is not a difficult problem, but minimize distortion of the mounting flange. Be careful not to let the screwdriver used to drive the mounting screw touch the plastic body during the tightening operation. Such contact can result in damage to the plastic body and internal device connections.

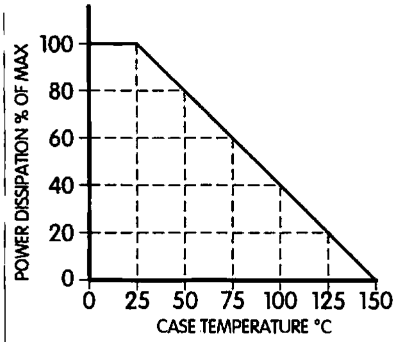


Fig. 1. Power dissipation derated for temperature, for 2N3904 and similar transistors.

Mounting the TO-225 Thermopad package presents a more obvious problem, because the mounting hardware goes through the body of the case. It is apparent that excessive mounting torque can distort the case, which may damage the internals. A compression washer under the screw head and a flat washer between the lock washer and the transistor will limit the pressure applied to the transistor. A split lock washer should be compressed but not flattened. When it's flattened it's just like a flat washer, and it loses its locking ability.

Stud-mounted devices can be overtorqued and warp the hex base as well, which may crack the semi-conductor die. A flat washer and lock washer will limit the force applied to the stud.

A piece of equipment designed for intermittent duty can often be increased to continuous duty with the addition of an appropriate heat sink. A heat sink does little or nothing for the pulse ratings of the transistor, because the thermal time constant is so short. A heat sink can limit the case rise to something close to the internal temperature of the cabinet. The heat sink may allow the extra margin, and the temperature rise of the output stage can be brought down from hot to warm.

In the discussion above, the thermal resistance between the transistor case and the heat sink was assumed to be zero. Imperfections in the mating surfaces of either the transistor or the sink produce small air spaces that result in a non-zero thermal path. The thermal resistance can be as high as two or three degrees C/W. Thermal grease or low-durometer-reading thermally conductive pads can be used to fill those spaces and reduce the thermal resistance by 50% to 75%. Thermal grease is the most common interface between transistor and heat sink used in home projects. The grease should be applied sparingly—just enough to fill the minute air gaps at the case-to-sink interface. A little is better than a lot. If you can see the grease, it's probably too thick. The thermal resistance of properly applied grease is in the order of 1° C/W. When mica or other hard insulators are used between the transistor and heat sink, the grease should be applied to both sides of the insulator.

Thermal grease has another application at the workbench other than providing the interface between transistors and heat sinks: It is an excellent thermal interface as well as a lubricant or release for soldering iron tips. Petroleum lubricants will burn away in time and make a bad situation worse.

The calculations of temperature rise aren't difficult or laborious, but finding the thermal characteristics of a transistor or heat sink may require a little digging. A heat sink can save money in the long run and maybe even in the short run. With the right heat sink you can turn on the power with confidence. It's been said that transistors must work on smoke—because they don't work very well after you let the smoke out of them.

Keeping the transistors cool while you're debugging a circuit or until you're sure of the power dissipation is an interesting challenge. One lab had a workbench with a built-in heat sink cooled with chilled antifreeze coolant. Such a heavy-duty setup is extreme, but an extruded heat sink upside down in a baking dish of ice water is an excellent short-term substitute.

Remember: However you do it, a cool transistor is a happy transistor!

Look, Ma — No Knobs!

Exploring the revolutionary new Kachina 505DSP computer-controlled HF transceiver.

Richard Lubash N1VXW
P.O. Box 311
Dublin NH 03444
[rlubash@poco.mv.com]

A few months back, when I received a call from *73 Magazine* asking me if I would be interested in reviewing Kachina Communications' first foray into the HF amateur marketplace, I jumped at the opportunity. I had heard about this revolutionary new concept in amateur communication equipment design at Dayton, and ever since, I had been dying to get my hands on one. So interested was I that I had even downloaded a demo software package from Kachina's Web site months before the rig was released.

The 505DSP, in case you haven't heard, is the first big step in the next generation of HF rigs. It not only incorporates Digital Signal Processing technology that meets or surpasses anything available today for ham equipment, but also provides front-end control of the transceiver via a computer-based software interface. Now, I'm not talking an HF rig bristling with knobs and buttons and an RS-232 port on the back with an available CAT program as an alternative to knob twisting. I'm talking a fully-featured state-of-the-art transceiver with just one button for on/off. Now *this* is different!

The beauty of this radio is that you have complete control of all transceiver functions via software. From an operating point of view, the 505DSP is a lot less cluttered and complicated than a 100+ knob radio, but has the capability of reaching any level of control depth the operator wishes.

Needless to say, when the big box labeled Kachina Communications arrived, I was excited. As fate would have it, I was one day away from leaving for a trip, but that didn't stop me from dropping everything and spending the next few hours engrossed in being a radio pioneer. The 505DSP comes well-packaged in a double box that contains everything needed to set the radio up. In my case, I would be operating the radio using a laptop, so it was necessary for

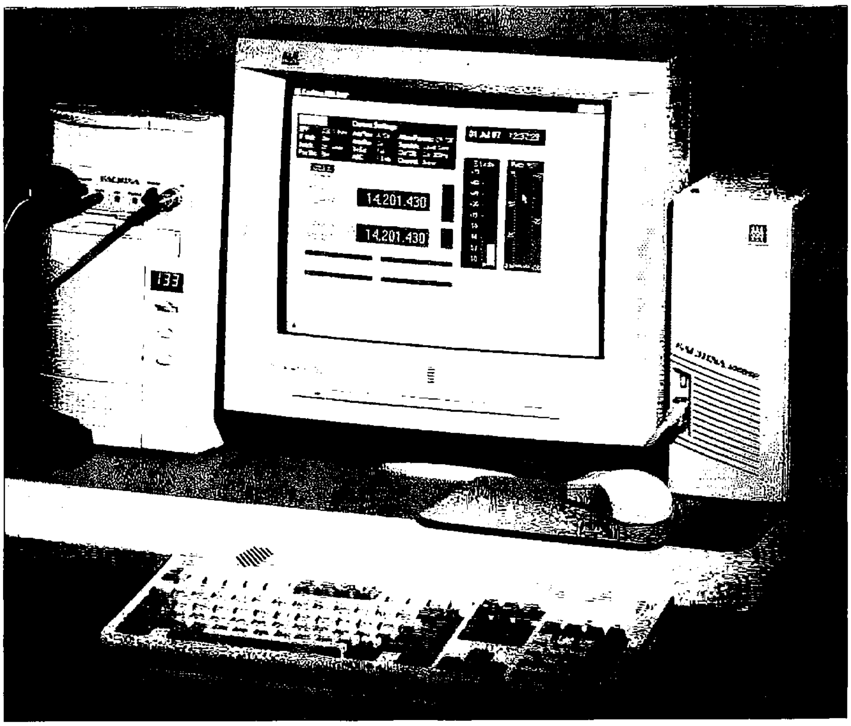


***Photo A.** The revolutionary new 505DSP looks more like a computer than an HF rig.*

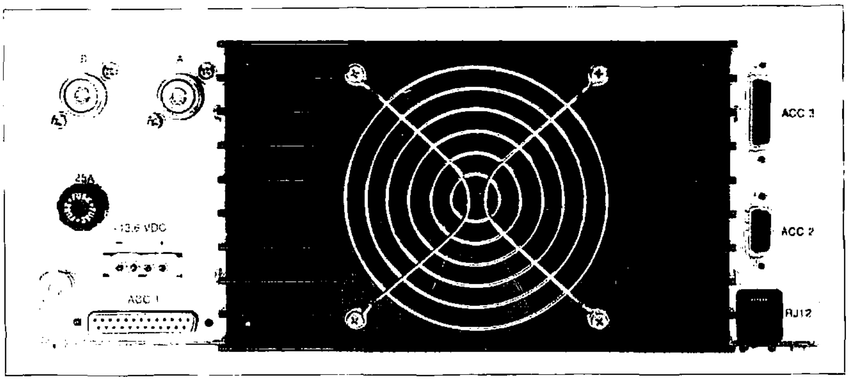


Photo B. *Accessory input/output on the 505 is accomplished via Sub-D computer-type connectors. The large fan runs all the time but is extremely quiet.*

Kachina to supply an additional box that accommodated the control head cover and extra cabling. The basic transceiver comes with a hand microphone and all cabling and parts necessary for the control head to mount in a spare hard drive bay in your computer. If your computer also has a sound card and speakers, an external speaker is not necessary. The 505 also requires an external 13.8 volt DC supply capable of supplying 25 amps continuous power. A high speed antenna tuner is also available for the 505DSP, and was included in the model sent to *73*.

Computer requirements for the 505 are on the light side considering the functionality of the supplied Windows™-based software. For my operation, I used a 586 laptop with 8 Mb of RAM running Windows95™. The control software is compatible with Windows 3.1, 95, or NT and only requires a 386DX or higher processor and 4 Mb of RAM (8 Mb RAM recommended for Windows95). Other computer resources required are a spare serial port and 2 Mb of hard disk space.

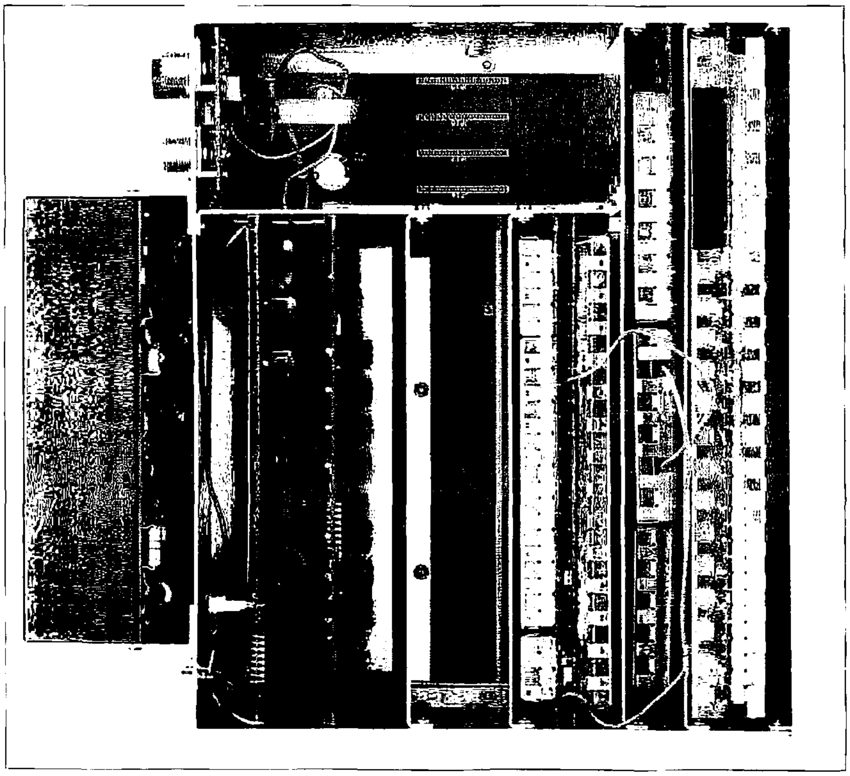


Photo C. *The inside of the 505 is neat and uncluttered as a result of modular plug-in cards.*

Getting the Kachina 505 up and running was a breeze. It took all of 15 minutes to hook up the rig to the power supply and computer and load in the software with the aid of the well-written installation manual. (I was a little worried at the mere 16-page thickness of the installation and operation guide until I discovered that the main manual is virtual and contained just a mouse-click away in the operating software.)

The software interface was very intuitive, so I decided to take the rig for a spin with just a few glances into the manual. I tuned up to 10 meters using a 10-element log periodic. I was able to get a weak copy on OH8JSZ through the Arctic flutter and then turn around, and via the miracle of DSP noise reduction, get a readable copy on ZK1DI coming in from Cook Island on 12 meters.

The sound of the 505DSP running into a three-inch external speaker was pleasant, with excellent clarity. Weak stations were very readable, and the fidelity on strong stations down on 20 meters made copy comfortable without that traditional communications mid-range sound. Tuning is accomplished using the up/down arrows on the keyboard, with the left/right arrows choosing the tuning resolution from 1 Hz to 10 MHz.

The virtual control panel is uncluttered and easy to read, a departure from some of the newer high density front panels of the new generation of HF rigs. The main window consists of a current settings status box that gives a readout of most of the main transceiver operating parameters, including filters, IF shift, notch, power, antenna port, tuner status, AGC time, Tx Eq, input attenuation, squelch, CW offset, and RIT. Below that is Tx and Rx frequency, mode, receive volume, and two "soft" faders that are used to select settings for any of the transceiver's adjustable parameters. The "soft" faders can be selected through hot keys, menu selection, or clicking on the individual items in the Settings box. On the right of the control window is a date/time readout, two-meter modules,

Inside the 505DSP (excerpt from Kachina's Web page)

The 505DSP's first mixer is a high-level diode ring, followed by high-level, low-distortion amplifiers, and 20 kHz-wide 75 MHz roofing filters. The gain of the 75 MHz stages is sufficient only to overcome the mixer and filter losses, and gain-controlled to prevent overload of the second mixer and the following 40 kHz IF stages. Most of the receiver gain takes place in the 40 kHz IF amplifiers which, to prevent ringing, use minimal LC selectivity. The output of the 40 kHz IF amplifier is then fed to the DSP portion of the radio, where the digital selectivity and processing take place. In the case of the 505DSP, the center IF frequency is a 40 kHz signal. The receiver IF strip has a bandwidth of 15 kHz at the maximum attenuation points, which means that signals ranging from 32.5–47.5 kHz are presented to the A/D converter. If we now choose a sampling frequency of 31.25 kHz, the center frequency will be translated down to 8.75 kHz (40–31.25). The string of signals is analyzed and processed at the 31.25 kHz rate, which is lower than the 40 kHz signal frequency. But as SSB signals require only about a 3 kHz bandwidth, we can bandpass filter again and again, reducing the sampling rate to as low as twice the bandwidth. By reducing the passband width, so we can reduce the sampling rate. As a result, digital filters may be narrowed down to previously unheard-of bandwidths without the ringing associated with crystal and mechanical filters—as low as 100 Hz, in fact, as in the 505DSP.

Two synthesizers provide low phase noise injection voltages to the mixers, which translate signals to and from the 75 MHz and 40 kHz IF amplifiers. The first local oscillator is a state-of-the-art DDS/PLL hybrid with a basic tuning step of less than 0.5 Hz. Control software, however, limits the user to 1 Hz steps. The second local oscillator is a VCXO. It supplies fixed-frequency injection to the second mixer. Both local oscillators are phase-locked to a common, precision, reference oscillator.

The reference oscillator is microprocessor-compensated against temperature. A DC voltage supplied by the DSP part of the circuit allows the reference oscillator to be calibrated against a reference signal (WWV, for example).

Product detectors and balanced modulators are mixers (IF and BFO signals mixed to produce an audio signal; microphone and BFO signals mixed to produce an IF signal). These are further mixers in a chain of mixers. DSP uses the phasing method to produce SSB. One sideband of a double sideband signal is phase-canceled, the other reinforced—the method used in the old phasing rigs, except that in DSP, the phase shift is constant with frequency. No mechanical carrier balancing is involved. The opposite process takes place in the receive mode.

General specifications

Frequency coverage, Tx: 1.8–2.0, 3.5–4.0, 7.0–7.3, 10.1–10.15, 14.0–14.35, 18.068–18.168, 21.0–21.45, 24.895–24.995, 28.0–29.7 MHz

Frequency coverage, Rx: 0.1–30 MHz

Frequency stability, short term: Can be automatically calibrated to within ±10 Hz of WWV or other external standard

Modes: USB, LSB, AM, CW

Power requirements: +13.8 V DC nominal; 25 A maximum (Tx), 2 A maximum (Rx)

Operating temperature range: -10° to +50° C

Transceiver dimensions/weight: Length, 32 cm. Height, 29.5 cm. Width, 1.5 cm. Weight, 5.27 kg. (12.5 x 11.5 x 4.5 inches, 11.6 lbs.)

Control head dimensions/weight: Length, 17.5 cm. Height, 4.5 cm. Width, 5.0 cm. Weight, 0.58 kg. (6.8 x 1.75 x 5.85 inches, 0.26 lbs.)

Receiver

SSB sensitivity: 0.18 μV (2.4 kHz filter, 10 dB SINAD, preamp on), 0.35 μV typical (2.4 kHz filter, 10 dB SINAD, preamp off)

AM sensitivity: 0.6 μV (preamp on), 1.0 μV typical (preamp off)

Audio power (5 μV input): >2 W into 8 Ω, >4 W into 4 Ω

Spurious rejection: >80 dB

Image rejection: >80 dB

IF rejection: >80 dB

3rd-order intercept point: +18 dBm typical @ 20 kHz (preamp off)

3rd-order IMD dynamic range: 96 dB typical (preamp off)

2nd-order intercept point: +49 dBm typical

Blocking dynamic range: 115 dB typical @ 20 kHz (preamp off); 118 dB typical @ 50 kHz

Audio THD: <5% @ 2 W into 4 Ω

Manual notch depth: >-50 dB

Continued on page 30

continued from page 29

Transmitter

Output power: SSB. 100 W ±dB into 50 Ω; AM: 25 W carrier nominal
Spurious harmonics: <60 dBc @ q00 W into 50 Ω
Carrier. opposite sideband suppression: SSB: <-55 dBc
CW keyer speed: 5–80 wpm, adjustable

and a full list of keyboard shortcuts that can be turned on or off.

That's all there is to it. The whole rig can be controlled from this simple, easy-to-read control panel. To upgrade the control panel to the newest, most advanced version, all you need to do is download it from Kachina's Web site on the Internet.

The software that is used at present to control the Kachina 505DSP is 16-bit Win 3.xx-compatible. The reason for this is that Kachina wants the software to run on any machine down to a 386 with 4 Mb of memory. They are working with other developers, and it should not be difficult to have OS and hardware-optimized software for the 505. Kachina is also planning to work with third-party developers to create software linking with Logging and HF Data software to produce an integrated station software concept.

Firmware upgrades are fully accomplished by inserting PCMCIA type-2 cards into the two slots on the processor board. Kachina will provide these as part of their upgrade policy, which means you will be able to completely upgrade firmware for the cost of the card. They chose this method to provide ease and control of upgrade installation, and ensure speed compatibility with the 21 MHz processor in the CPU. In addition, because the 505DSP is constructed more like a computer with its plug-in card bays than a traditional HF rig, even major replacements and repairs can be accomplished by swapping cards, instead of sending in the radio. Another aspect of the rig that brings to mind computers is the rear panel. All connectors other than the two antenna PL-259 connectors are either subminiature D-type computer or modular phone-type connectors. The ACC1 connector provides for TNC, phone patch, PTT, and related audio connections. ACC2 allows for an external automatic antenna tuner, and ACC3 provides for interface with a power amplifier. In addition, an RJ12 modular connector can be used to operate the rig with the computer and rig separated by up to 75 feet.

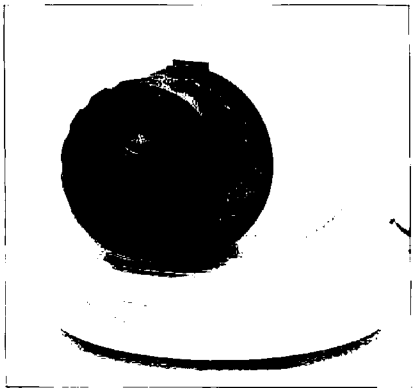


Photo D. For the hard-core knob twisters, Kachina offers an optional main tuning control.

The 505DSP uses a double conversion receiver with IF stages at 75 MHz and 40 kHz. The DSP operates at 40 kHz before the AGC and is the highest frequency IF-based DSP on an amateur transceiver. The transmitter also uses DSP for phase-canceled sideband suppression. All filtering is DSP-based, thus eliminating the need for expensive optional crystal filters. Kachina does not supply a schematic with the radio, but a free one can be obtained by sending a request to the manufacturer. An explanation of the rig's operation can be seen in the sidebar "Inside the 505DSP."

Since the front panel of the 505DSP is your computer keyboard and screen, a short tour of the software is necessary to get the hang of things. The Help menu is adequate in getting you started. The only thing I missed was the ability to print out all or part of the menu, so I would not have to bounce back and forth between help windows. I have included an in-depth look at the supplied software (version 2.21) in the sidebar "On the Menu." I found the software easy to use, but was only able to operate the rig with the speed of a nonvirtual radio after I had taken the time to learn the keyboard commands.

Using the 505 to full potential takes a bit of learning. The curve is not high, but to get the speed and agility necessary for contests or jumping into a DX pileup, it is necessary to know what keys to press without having to refer to the help or shortcut menu. I found after I had mastered these skills, I was able to perform DSP, tuning, and split functions with a few key clicks that made operation actually faster than reaching out and twisting knobs or going into the arcane menu systems of conventional rigs.

The only operation that I found a little difficult to get used to was tuning without a knob. After years of having that large flywheel control to rock back and forth when trying to dig that elusive DX out of the noise, up/down arrows proved a bit difficult. The bottom line is, even old hams can learn new tricks, and by the time I sent the rig back I was up/down tuning on the Kachina with the best of them. Kachina, in recognition of the ham/tuning knob fetish, has developed an accessory tuning knob that sits on your operating desk and connects to a spare Com port on your computer. This accessory should be shipping by the time you read this review.

Operation of the 505DSP proved to be a joy. Though I was expecting a high-quality rig, I was still pleasantly surprised by how well the receiver performed. I was able to use the rig in the

On the Menu
(a look at the 505DSP control software)

Since the front end of the Kachina is your computer—instead of an array of knobs, buttons, and switches—to provide an effective discussion of the radio's functions it is necessary to include a software review to make this article complete.

Here are the basic Menu Bar functions (almost every Menu Bar function has an equivalent "hot key," so it is not necessary to go into the menus with the mouse to control the radio).

Filters menu

The Filters menu provides access to DSP bandpass filtering at 3.5 kHz, 2.7 kHz, 2.4 kHz, 2.1 kHz, and 1.7 kHz for SSB; and 1 kHz, 500 Hz, 200 Hz, and 100 Hz for CW. This, plus two data filters, eliminates the need for costly crystal filters. IF shift, manual, and automatic notch with three variable notch widths are also available in the filter menu.

Tx menu

The Tx menu allows you to vary transmit frequency, mike gain, power out, speech monitor, audio monitor, vox controls, amplifier on/off, and transmit equalization.

Rx menu

The Rx menu includes direct frequency entry, a bandswitch, AGC speed, attenuator, squelch, noise reduction controls, and RIT.

Ant menu

Ant menu allows you to retrieve and display your antenna impedance data in the form of a Smith Chart for each of the HF bands, engage the automatic antenna tuner, and select the antenna you wish to use for each band (antenna port A or B).

CW menu

The CW menu gives operator access to the CW keyer functions of QSK or semi break-in, speed, dynamics, weight, and sidetone level. CW functions, including CW filter default, left/right/straight key options, nine transmit message buffers, and a "live type" CW feature which allows direct keyboard-to-CW entry.

Meters

Meter selection of the two digital meters includes receive meter calibrated in S-units, volts, or dBm; and transmit meters calibrated in forward power, reflected power, ALC, and SWR.

Channels

The Channels menu provides interface to the memory functions of the 505. The recall command will open a window with 100 memories capable of storing Tx/Rx frequency, mode, AGC setting, and filter settings. These memories are divided into five groups, and can be scanned using varying dwell time and squelch hold. Memories can be saved, printed, and cleared through menu choices, and a specified frequency range can be scanned in user-defined frequency increments.

Special

The Special menu is the largest of the pulldown menus and allows access to a multitude of the 505's software features. The user can access the internal logging program and lock controls; change tuning and slider rates; set the clock; monitor heat sink temperature; calibrate the receiver; and do a selective frequency sweep. The last two functions are quite interesting. The frequency calibration allows the user to input a standard frequency (I used WWV) and then let the radio tune to that frequency and perform an internal calibration against the reference frequency. The frequency sweep allows the user to select a frequency and ± deviation and then do a signal or continuous sweep, creating a graph of band activity. The resultant graph can then be clicked on to move the receive frequency to any source of band activity.

Help

The Help menu "is" the manual. It provides a complete on-line description of all radio functions and menus as well as a searchable index. The Help menu also allows for the continuous display of all shortcut keys, which makes learning

Continued on page 32

keyboard commands a lot easier. Help selections are broken down into subcategories which include: tuning, buttons, slide bars, shortcut keys, main menu, function keys, user's guide, and Com port setup instructions. The function keys provide 16 user-definable settings.

Quit

Quit exits the 505 control program.

ARRL International DX SSB Contest, and was very impressed by the DSP filtering. The Kachina, with filters set to 1.7 kHz and tuning steps set at 100 Hz, allowed me to tune up and down the crowded 15- and 20-meter bands as if I were working a channelized rig. By using a combination of DSP filtering, IF shift, notch, widely variable AGC, and noise reduction, I was able to tune and work weak stations in the midst of the SSB chaos that occurs in a contest. I was very impressed with the rig's computer-based contest potential. The only thing lacking at this time to make the 505 a viable contest alternative is the need for third-party software to be integrated with the control software to automate contest data entry.

Day-to-day operation of the 505, away from the hubbub of a crowded contest weekend, proved to be pure joy. I made many QSOs with the rig and received excellent reports on audio and signal clarity. I spent a few Sunday mornings on my regular sked with Bob Moss W3GJQ (who is quite a bit more into SSB audio than your average ham) and worked to optimize the audio sound of the Kachina. Out of the box, with the supplied hand microphone and factory audio settings, the rig sounded good, but with a little fiddling, and constructive feedback from Bob, I was able to get the rig sounding *great*. We were only able to speculate about how the rig might have sounded with a high-end microphone driving it. I did, during the time I had the radio, speak to other Kachina operators, including Doug Smith KF6DX at the Kachina Club Station in Arizona, and was singularly impressed with the audio quality of the radio. My only complaint at the time of this writing is with the speech processor. Although the processor does perform its appointed function of increasing the apparent signal for working weak-signal stations or pileups, I found the audio quality with

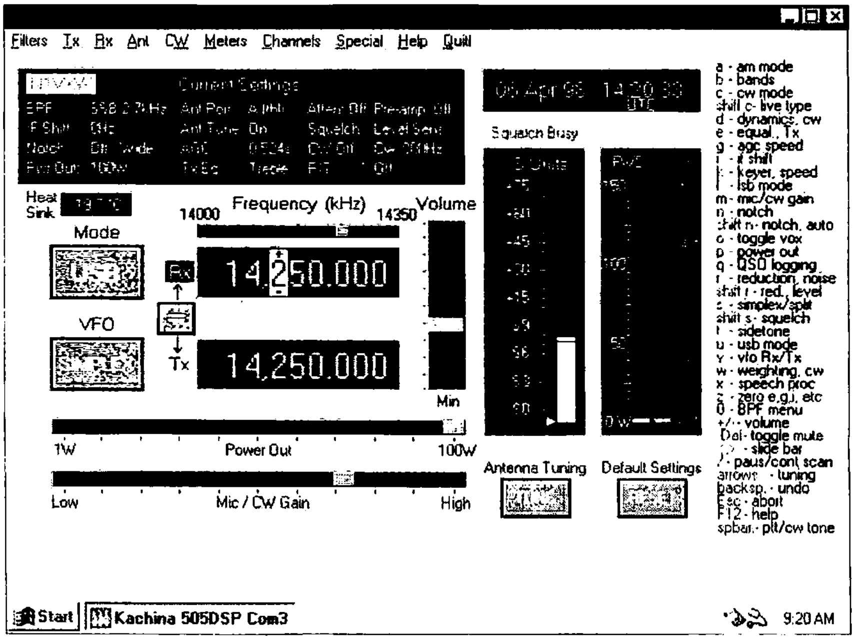


Photo E. *This is the versatile virtual front end of the 505DSP.*

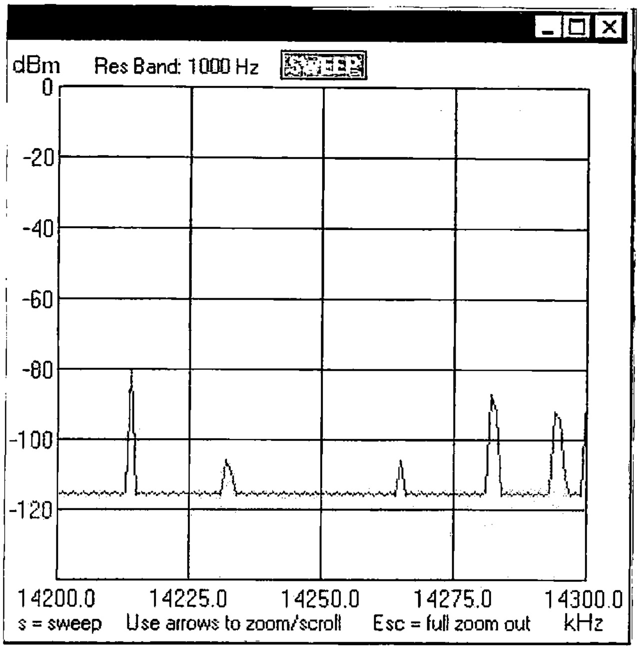


Photo F. *Band activity is shown on the Sweep screen.*

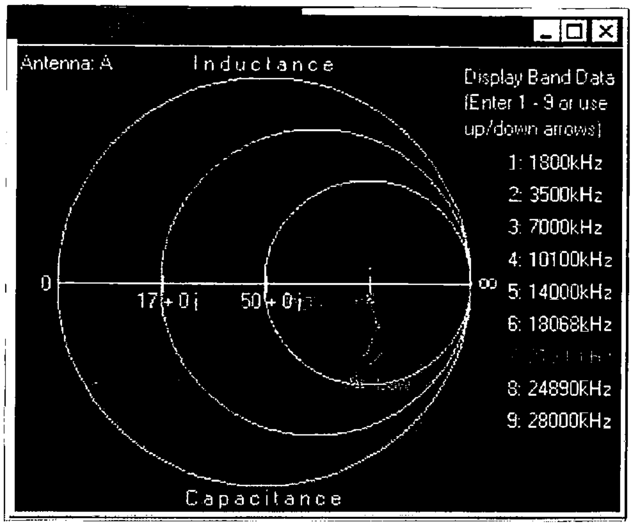


Photo G. *Antenna LC data is displayed on a band-specific Smith Chart.*

the processor on to be a little rough, and left it off except when needed. Kachina informed me that they were working on this, and a modification was forthcoming.

CW operation on the Kachina proved to be a very pleasant experience. Menu selection lets you set up your paddle for left- or right-hand operation, speed, weight, and dynamics. All controls are accomplished from the two soft faders and allow the operator to tailor his CW signal to individual tastes. Sidetone frequency and level can be set from the menu, which I find a real plus (owning an 80-pound rig that requires picking up and the use of a screwdriver simply to adjust sidetone level). In addition, the software supplied with the 505 lets the operator type directly into the rig to produce CW. This feature is fun and also allows messages of up to 59 characters to be stored in nine memory buffers.

Other features of the Kachina include a band scope that will sweep a predefined portion of the spectrum for signal activity. Though the sweep requires a momentary muting of the receiver audio, the resultant graph allows the operator to jump from signal to signal by simply clicking the mouse on the graph. Refresh rates and sweep parameters are controlled by software; all in all it is the best software-based band scope I have seen to date for amateur equipment.

Another software plus is the Smith Chart feature. The antenna tune function on the radio not only remembers the tune setting for previous frequencies, but also applies the data to a band-specific Smith Chart that can be used to analyze the characteristics of any antenna connected to the 505. The antenna tuner is quick, quiet, and fast. Kachina rates it as being able to tune any antenna up to a 3:1 SWR, and that proved to be true with the antennas I connected to the 505. One of my favorite features was the Snapshot Keys. By pressing a combination of F1 through F8, shift and control, you are able to take 16 different memory snapshots of current receiver settings and assign them to "F" keys. This beyond-quick memory function has uses that are only limited by the imagination of the operator. Another plus is the backspace key. Imagine being able to undo the last 10 changes you made to the parameters of your radio!

When all is said and done, the Kachina 505DSP proves to be a very capable first effort from a company that has been supplying commercial and military communications equipment for a long time. The radio, in my opinion, provides a high value per dollar when compared to similarly priced radios, in that the front panel controls are in your computer, letting the manufacturer invest the cost difference in technology. The ability to upgrade control software or use or write custom software, combined with low-cost PCMCIA card firmware upgrades, makes this a rig that can grow and last into the future without being obsolete out of the box.

For more information, check out the Kachina Web site at [www.kachina-az.com]. The Kachina 505DSP HF transceiver is manufactured by Kachina Communications, Inc., P.O. Box 1949, Cottonwood AZ 86326. Telephone (520) 634-7828; FAX (520) 634-8053; E-mail [KACHINA@sedona.net]. Price, $1995. With antenna tuner, $2234.

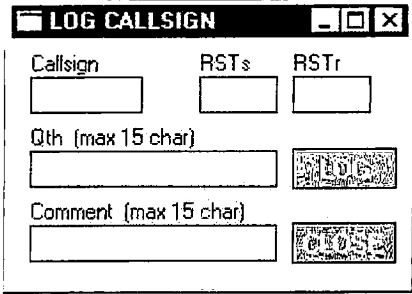


Photo H. *The 505DSP software includes a basic logging program.*

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the November issue, we should receive it by Aug. 31. Provide a clear, concise summary of the essential details about your Special Event.

AUG 1–2

JACKSONVILLE, FL The 25th annual Greater Jacksonville Amateur Radio & Computer Show will be held August 1st and 2nd at the Osborn Convention Center in downtown Jacksonville. The site is conveniently located one mile north of the I-95/I-10 junction. Take the Forsyth St. exit off I-95. Activities include forums and group meetings, a huge indoor swap area, and commercial exhibitor booths. Testing for all grades of ham license will be at 9 a.m. Sunday in the lobby area. Walk-ins are welcome. Hours are 9 a.m.–5 p.m. Saturday, and 9 a.m.–3 p.m. on Sunday. Exhibitor and swap area setup is Friday July 31st, 1 p.m.–6 p.m., with drive-in access for easy unloading. Admission is $8 at the door. Swap tables are $25 each for the weekend. Tables may be ordered from *Karl Hassler N4DHG, 2767 Scott Circle, Jacksonville FL 32223. Tel. (904) 268-2302.* Commercial booths are available via *Menard Norton KE4IOR at (904) 384-6750 or E-mail via [ke4ior@juno.com].* Headquarters hotel is the Jacksonville Omni with a special rate of $69 to those mentioning the hamfest. Phone *(904) 355-6664 or 1-800-843-6664* for reservations. Free parking is available in the main convention center parking lot and the entire hamfest is air-conditioned. Many alternative activities are available in the area. Talk-in is on the 146.76 rptr. or for more details, check the Web site at *[http://www.pobox.com/~w4ue/hamfest.html];* or write *Greater Jacksonville Hamfest, P.O. Box 27033, Jacksonville FL 32207.* The 1997 Greater Jacksonville Hamfest was designated the ARRL National Convention and the eight participating clubs plan an even bigger show this year. All proceeds go to upgrading amateur radio projects and activities in northeast Florida.

AUG 2

ANGOLA, IN Land of Lakes ARC will sponsor a Hamfest Sunday, August 2nd, 7 a.m.–2 p.m. at Steuben County 4-H Fairgrounds, corner of 200 W. and 200 N., Exit 150 off I-69. Free parking, camping, chicken BBQ, swimming, amusement park and outlet shopping nearby. Indoor tables $8, trunk sales $2. Vendors setup Saturday, August 1st, 3 p.m.–10 p.m., Sunday, August 2nd, 4 a.m.–7 a.m. Not responsible for theft or accidents. Advance tickets $3, gate tickets $4. Advance sales end July 22nd. For more info, contact *Theresa J. Limestahl KB9NNR, P.O. Box 346, Fremont IN 46737. Tel. (219) 495-5403; FAX (219) 495-1675. Packet [KB9NNR@N9LCF].* Talk-in on 147.180 pl 131.8, 444.350, packet 145.510.

BERRYVILLE, VA The Shenandoah Valley ARC, of Winchester VA, will present the 48th Berryville VA Hamfest at Clarke County Ruritan Fairgrounds, 6 a.m.–3 p.m. Talk-in 146.830. Admission $5. Tailgaters $7 (indoor spaces available by reservation). VE exams by the Mountain ARC Teams. Contact *Tom Martin KF4TNX, (540) 323-0074. E-mail [hamfest@Vvalley.com], or write to Shenandoah Valley Amateur Radio Club, P.O. Box 139, Winchester VA 22604.*

MARSHFIELD, WI The Marshfield Area ARS will hold their 7th annual "Hamnic" (a potluck dinner/swapfest) on Sunday, August 2nd, at Wildwood Park Shelter in Marshfield WI. Gather around 11 a.m. Talk-in on 147.180 or contact *Guy Boucher KF9XX, 107 West Third Street, Marshfield WI 54449. Tel. (715) 384-4323. E-mail [guyboucher@tznet.com]. Packet [KF9XXX@W9IHW.E5. AI.WI.USA.NA].* All are welcome!

RANDOLPH, OH The Portage ARC "Hamfair '98 For Radio Amateurs and Computer Enthusiasts" will be presented at Portage County Fairgrounds in Randolph (between Akron and Youngstown, on St. Rt. 44, 4 miles south of I-76). The event will take place from 8 a.m. to 4 p.m. Unlimited free parking. There will be indoor vendors and a huge flea market. Setup begins at 6 a.m. An on-grounds restaurant will serve breakfast and lunch. Advance tickets (available until July 15th) are $4; $5 at the gate. Other features include Worked-All-States card checking and ARRL officials to answer your questions and bring you up to date with what is happening. Indoor tables with electricity are $10 each. Flea market spaces $3 each. For reservations or info and tickets, contact *Joanne Solak KJ3O at (330) 274-8240.* Mail registration with a check/m.o. for the total amount, payable to *Portage Amateur Radio Club, 9971 Diagonal Rd., Mantua OH 44255.* Talk-in on 145.39 (-600 MHz). Get a look at the Web site at *[http://parc.portage.oh.us].*

AUG 8

HUNTINGTON, WV The Tri-State Amateur Radio Assn. (TARA) will hold their hamfest at the Huntington Memorial Fieldhouse at 2590 5th Ave. For more information call *Bernie Mays at (304) 743-5459, or E-mail to [wb8zer@juno.com].*

LEWISTOWN, PA Juniata Valley ARC will hold a Hamfest August 8th, 8 a.m.–1 p.m. at Decatur Township Fire Company grounds. Follow US Rt. 522 North to the site, which is eight miles east of Lewistown. Admission $1. Tailgating $5. Indoor tables $10. Talk-in on 146.91. For info call *Rich Yingling WB3COB at (717) 242-1882.*

OSCODA, MI The 1998 I.C.A.R.E. Hamfest will be held at Oscoda Airport in the Yankee Air Force Museum, Oscoda MI, 8 a.m.–2 p.m. Setup at 6 a.m. $3 trunk sales, tickets $4 in advance, $5 at the door. Tables $7 each. Free overnight RV parking available. VE exams with 9 a.m. check-in. Mail ticket orders with an SASE payable to *I.C.A.R.E., P.O. Box 271, Oscoda MI 48750.* For more info, call *(517) 739-2896,* or *(517) 739-3129. E-mail [ka8aip@centuryinter.net].*

AUG 9

FRANKFORT, KY The Bluegrass ARS will hold its annual Central Kentucky ARRL Hamfest 8 a.m.–4 p.m., August 9th, at Western Hills High School in Frankfort. From I-64 exit 53 take Route 127 north 0.7 mile. Turn left at the third stop light and follow the signs. Admission is $5 in advance, $6 at the door. For VE exams contact *Bill Fuqua WA4LAV* by July 31st at *(606) 272-9523; or E-mail [wlfuqu00@pop.uky.edu].* Indoor and outdoor flea market, commercial vendors, forums, free parking, and refreshments. Handicapped accessible. Vendor setup starts at 6 a.m. Tables are $15 before August 1st, $25 after August 1st. Tailgating is free with admission. Talk-in on 145.390(-) (Frankfort) and 146.760(-) (Lexington). For info and reservations contact *John Barnes KS4GL at (606) 253-1178 evenings; E-mail [KS4GL@juno.com];* or SASE *John Barnes KS4GL, 216 Hillsboro Ave., Lexington KY 40511-2105.*

ST. CLOUD, MN The St. Cloud Radio Club will hold its 50th annual Hamfest on August 9th at Whitney Senior Center, St. Cloud MN. VE exams begin at noon. Talk-in on 146.94 and 147.015. For info and tickets contact *WØSV, 401 Great Northern Dr., Waite Park MN 56387. Tel. (320) 255-1410. E-mail [jmaus@cloudnet.com].* Check the Web site at *[WWW.WØSV.ORG].*

AUG 15

BURFORD, ONTARIO, CANADA The Brantford ARC will host "Hamfest '98" at the Burford Fairgrounds on Hwy 53, 15 km west of Brantford, Saturday, August 15th. Free parking. Doors open to the public at 9 a.m.

Admission $5, children under 12 free. Tables are $8 each, plus admission. Tailgaters $4 plus admission. Vendors' gate opens at 7:30 a.m. Prepaid tables are guaranteed. Refunds only if canceled by August 5th. Tables not prepaid will only be held until 9 a.m. Reserve early if you have special requests such as wall tables, hydro access, etc. Special requests *must* be prepaid. For table reservations, contact *Richard La Rose VE3RLX, 153 Dunsdon St., Brantford ON N3R 6N3, Canada. Tel. (519) 752-2437; E-mail [rlarose@bfree.on.ca];* or *Brantford ARC, P.O. Box 25036, Brantford ON N3T 6K5, Canada; E-mail [ve3ba@bfree.on.ca].*

LONGVIEW, WA The Lower Columbia ARA, W7DG, will sponsor its 7th Annual Ham Radio, Computer, and Electronic Equip. Swap Meet 9 a.m.–3 p.m. at the Cowlitz County Fairgrounds in Longview. Take exit 26 or 39 off Interstate 5 and follow the signs west for the county fairgrounds. Mt. St. Helens and the Oregon coast are nearby. Admission is $3. Swap tables are $12 before August 1st, $15 after. Commercial tables $15. Free parking. Overnight RV parking on the fairgrounds for $10, elec. available. No VE exams. Vendor setup on Friday 5 p.m.–9 p.m., Saturday 6 a.m.–8:45 a.m. Talk-in on 147.26(+) pi 114.8. For more info write to *LCARA Swap Meet, P.O. Box 906, Longview WA 98632; or call Bob KB7ADO at (360) 425-6076 eves. E-mail to [KB7ADO@ aol.com].*

WASECA, MN The Viking ARS will hold a Hamfest and Craft Fair at Waseca County Fairgrounds, 8 a.m.–2 p.m. 8' x 8' inside spaces will be available to vendors for $15, or if booked and paid for by June 15th the fee will be only $10. Outdoor tailgating available for $8, or $5 if booked and paid by June 15th. General admission is $1, $3 for hams. Hams are eligible for door prizes and must have a license to qualify. For info or to book space, contact *Lloyd L. Schlaak, (507) 465-8619; E-mail [nØvfv@smig.net].* Talk-in on the 146.940 MHz WAØCJU rptr.

AUG 16

CAMBRIDGE, MA A tailgate electronics, computer and amateur radio Flea Market will be held rain or shine, Sunday, August 16th, 9 a.m.–2 p.m., at Albany and Main St., Cambridge MA. Admission $4. Free off-street parking. Fully handicapped accessible. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance—includes one admission; setup at 7 a.m. For space reservations or further info call *(617) 253-3776.* Mail advance reservations before Aug. 5th to *W1GSL, P.O. Box 397082 MIT BR., Cambridge MA 02139-7082.* Talk-in on 146.52 and 449.725/444.725 pi 2A W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

AUG 18

ANGELS CAMP, CA The Calaveras ARS will hold an Amateur Radio Flea Market Saturday, July 18th, 7 a.m.–2 p.m. at Utica Park in Angels Camp. Buyers free! Sellers $5. Talk-in on 145.170(-) pl 100. For more details call *Steve at (209) 878-3829 or Susan at (209) 795-0618.*

AUG 22

AUSTIN, MANITOBA, CANADA The Manitoba Amateur Radio Museum (MARM) is hosting its 4th Annual Hamfest on the grounds of The Manitoba Agricultural Museum at Austin, 1-1/2 miles south of Hwy. #1 on Hwy. #34. Admission is $5, indoor tables $5. The dance on Saturday at 8 p.m. is $8. Banquet $8. Camping $12 with elec., $10 without elec. Talk-in on 146.91(-). For further info, contact *Dave Snydal VE4XN, (204) 728-2463.*

BRIDGEWATER, NJ The Somerset County ARS, Inc., will hold their Annual Hamfest at the Somerset County 4H Center on Milltown Rd., just off Route 202, 8 a.m.–1 p.m. Setup is at 6 a.m. Call *Pat N2CQM, (732) 873-3394; FAX (732) 873-0052;* or write to *SCARS, P.O. Box 742, Manville NJ 08835. E-mail [scars@qsl.net].* The Web site is at *[http://www.qsl.net/scars].* Talk-in on 448.175(-5) pl 141.3, and 147.135(+6) pi 151.4.

WARSAW, IN The 2nd Annual Kosciusko Co. Hamfest and Computer Show will be held August 22nd, 8 a.m.–2 p.m. at Kosciusko County Fairground, Bronson & Smith St., Warsaw. General admission is $3. Inside vendor area (includes one 8-foot table) $5. Free flea market setup outside. VE exams at 2 p.m. Sponsored by Hoosier Lakes Radio Club of Warsaw IN. For more details call *Loren Melton WB9OST, (219) 858-9374 eves after 6 p.m. CDT. E-mail [WB9OST@WAVEONE.NET]. Talk-in on 146.985(-).*

AUG 23

CHEEKTOWAGA, NY The Lancaster ARC is the sponsor of the Greater Buffalo Hamfest and Computer Show which will be held August 23rd, 8 a.m.–3 p.m., at Hearthstone Manor, 333 Dick Rd., Cheektowaga NY. For more information check the Web site at *[http://hamgate1.sunyerie.edu/~larc/greaterbuffalohamfest.html];* or contact *Luke at (716) 634-4667; E-mail [lcalianno@aol.com].*

YONKERS, NY The Yonkers ARC Hamfest/Computerfest will be held at the Yonkers Municipal Parking Garage on Main St. in Yonkers. There will be no VE exams. Sellers, pre-registration is $10 per space, $14 per space at the door. AC power is available with pre-registration. Buyers: $5; XYL, YL, kids under 12 admitted free. For more info call *John at (914) 963-1021; or Jim at (914) 969-5182.* To pre-register, make checks payable to *The Yonkers Amateur Radio Club,* and mail to *Y.A.R.C., P.O. Box 378, Centuck Sta., Yonkers NY 10710-0378.* Include, name, call, date, address, city, state, zip, and number of spaces you are paying for. Talk-in on 146.865 and 440.150 rptrs., also on 146.520 simplex.

AUG 29

LA PORTE, IN The La Porte

County Electronics Assn's annual Summer Hamfest will be held 7 a.m.–2 p.m. Saturday, August 29th, at the La Porte County Fairgrounds, located 50 miles east of Chicago. Plenty of paved area for selling, and an air-conditioned building with eight-foot tables for vendors inside. Open at 6 a.m. for vendor setup. Tickets are $5, tables are $5, from *Rich Dugger WD9ARW, 4977 W. 150 N., La Porte IN 46350. Tel. (219) 326-6672. E-mail [lpcea@hotmail. com].*

AUG 29–30

BOXBOROUGH, MA The 1998 New England ARRL Convention at Boxborough MA will be held at the Holiday Inn Boxborough Woods Hotel and Conference Center, Route I-495. For information regarding exhibits, contact, day or evening, *Anthony Penta W1ABC, General Chairman, 88 Hill St., Topsfield MA 01983. Tel./FAX (978) 887-8887. E-mail [tony@shore.net].* For room reservations, contact *Mel Cole WZ1Q, Reservations Chairman, P.O. Box 8, Prides Crossing MA 01965. Tel. (978) 927-1953. E-mail [mel@shore.net].* For exhibit and advertising info, contact *Richard Cosma KD1BF, Exhibits Chairman, 95 Higgins Road, Framingham MA 01701-4311. Tel. (508) 877-8241; FAX (617) 248-6939; or E-mail [kd1bf@amsat. org].*

WOODLAND PARK, CO The Mountain ARC Campfest-Swapfest will be held Saturday, Aug. 29th and Sunday, Aug. 30th, at Colorado Lions Club Camp, four miles north of Woodland Park, on Hwy. 67 North. Free admission for buyers. $10 daily to camp and/or sell. Campers may set up camp Friday, August 28th after 2 p.m. Advance reservations requested. Contact *Judy KBØWGN at (719) 836-0217; E-mail [dsrtflwr32@ aol.com];* or mail reservations to *MARC, P.O. Box 1012, Woodland Park CO 80866.*

AUG 30

DUBUQUE, IA The Great River ARC, Iowa Antique RC and Historical Society, and the Tri-State Computer Users Group are getting together to sponsor the 5th Annual Hamfest Radiofest Computer Expo from 8 a.m.–2 p.m. at the Dubuque County Fairgrounds on Old Highway Rd., west of Dubuque. Features include free parking, camping (elect. available), dealers, flea market, tailgating, with VE exams at 10 a.m. Admission is $4 in advance and $5 at the door; 12 and under admitted free. Eight-foot tables are $8 each. Talk-in on 147.84/.24. Contact *Jerry Ehlers WØSAT, (319) 583-1016; Loren Heber NØYHZ, (319) 556-5755; or Jerry Lange KBØVIK, (319) 556-3050.* Write to *G.R.A.R.C., P.O. Box 546, Dubuque IA 52004-0546. E-mail [kbØlcj@mwci.net].* Visit the Web site at *[http:// grarc.mwci.net/].*

WOODSTOCK, IL The Tri-County Radio Group, Inc., will hold its 8th Annual Hamfest and Computer Extravaganza at the McHenry County Fairgrounds located just north of Route 14 on Route 47, beginning at 6:30 a.m. for the flea market and 8 a.m. for the exhibitors. (Setup available on Saturday, by appointment, or 6:30 a.m. on Sunday.) Talk-in on 146.52 (simplex). Reservation deadline is August 11th. For more info or reservations, contact *Bob Grosse N9KXG, (708) 944-0500. E-mail [TCRG@quality-enterprises.com].* Mail: *T.C.R.G., P.O. Box 3107, Skokie IL 6007-6107;* or visit the Web site at *[http://quality-enterprises.com/TCRG].*

YONKERS, NY The Westchester Emergency Communications Assn., Inc., will hold its Summer Radio and Electronics Hamfest, 8 a.m.–2 p.m. August 30th, at the Yonkers Raceway. This outdoor tailgating event will feature all types of new and used ham radio equipment, computers, CB, shortwave, scanners and other varieties of electronic equip., and parts. Free unlimited parking, handicap accessible. Admission is $6, children under 14 free with adult admission. Talk-in available on WECA's rptr. at 147.060 MHz, pi 114.8. For more info, please call the *WECA info-line at (914) 741-6606;* or visit the Web site at *[WWW.WECA.ORG].* WECA is an all-volunteer amateur radio organization whose members are dedicated to providing public service and emergency two-way radio communications in Westchester County and the surrounding areas.

SEPT 5

CARP, ONTARIO, CANADA The Ottawa ARC (OARC), Inc., is pleased to announce its 2nd Annual Hamfest. The event will be held Saturday, Sept. 5th, 10 a.m.–1 p.m. on the Carp Agricultural Fair Grounds (at Falldown Lane) in Carp. Take Highway 417 to the Carp Road exit, north to the fairground. Tables are $10 each, plus admission, tailgate spaces $5 each plus admission. General admission is $3. For info contact *Jim Cummings VE3XJ, (613) 446-1225; E-mail [fleamarket@ oarc.net].* Take a peek at *[http:// oarc.net/fleamarket]* on the Web. The OARC Hamfest is held at the Carp Agricultural Fair Grounds at the same time as the Carp Farmer's Market, so an additional bonus is that guests can also enjoy stocking up on farm-fresh produce, and crafts from local artisans.

UNIONTOWN, PA Saturday, Sept. 5th, the Uniontown ARC will hold its 49th annual Gabfest at the club grounds located on Old Pittsburgh Rd., just north of the intersection of Rts. 51 and 119. Free parking and free tailgate space with registration. The event starts at 8 a.m. Talk-in is on 147.045(+) and 147.255(+). Table space available. For more info contact *Carl WA3HQK or Joyce KA3CUT Chuprinko, Rte. 6 Box 231-CC Morgantown WV 26505. Tel. (304) 594-3779.*

SPECIAL EVENT STATIONS

JULY 26–AUG 8

KINCARDINE, ONTARIO, CANADA The Kincardine DX Group will operate XK3K to celebrate the 150th Anniversary of the Town of Kincardine. This special callsign will be used between 0000 UTC July 26th and 2359 UTC August 8th. Operation will be on all bands 80–10 meters, SSB and CW. Please send an SASE for QSL to *Bill Hardie VE3EFX, 755 Johnston Crescent, Kincardine Ontario N2Z 1S5, Canada.*

JULY 31–AUG 2

OSHKOSH, WI The Fox Cities ARC of Appleton WI will operate W9ZL from the Experimental Aircraft Assn. Fly-In and Convention (EAA AirVenture '98) at Wittman Regional Airport in Oshkosh. SSB-HF operation will begin on Friday, July 31st and continue through Sunday, August 2nd, in the General portions of the phone bands. RTTY operation will be mostly on 7085 and 14085. Operators of the club will man the station from 8 a.m.–4 p.m. daily. A special 8 x 10 certificate is offered for contacts with proper QSLs. QSL to *Wayne Pennings WD9FLJ, 913 N. Mason, Appleton WI 54914 USA.*

AUG 1–8

NEWARK, NOTTINGHAMSHIRE, ENGLAND Nottinghamshire Scouts and Guides will operate Station GB98RH from the Sherwood 98 International Camp at Walesby Forest Scout Activity Centre, a 250-acre site located in the Sherwood Forest area of Nottinghamshire. The site will be the home for a week to over 7,000 Scouts and Guides, representing over 26 countries and five continents. Depending on conditions and the availability of operators, the station expects to be QRV between 0800 and 2400 UTC on 80 m, 40 m, 20 m, 18 m or 12 m, 15 m or 10 m, and 6 m, 2 m, or 70 cm. Outside of these times band occupancy will be more restricted. Modes will be mainly SSB and CW with perhaps some RTTY and Packet.

AUG 5–8

ELGIN, IL The Antique Radio Club of Illinois (ARCI) will, for the first time, have a vintage amateur station *transmitting* on August 5th–8th, at Radiofest XVII, from the Holiday Inn in Elgin. Radiofest XVII is one of the nation's largest gatherings of antique radio collectors held each year. N9CQX will be the host and will be assisting individuals, who must bring current copies of their

licenses, to broadcast over a variety of vintage tube radio equipment. The station will operate AM phone and SSB on 80, 40, 20, 15, and 10 meters. Contact (or receive) station N9CQX on either of these days and send a reception report along with a LSASE to ARCI for a QSL certificate. For more info about this rare opportunity, or for more info about Radiofest XVII, E-mail *[arci31280@aol.com]*. Visit the Web site at *[http://members.aol.com/arci31280/arci.htm]*.

AUG 8–9

OSCODA, MI Station K8Y, working at the Yankee Air Force Museum (formerly Wurtsmith Air Force Base), will operate 1300 UTC Aug. 8th—2100 UTC Aug. 9th. Freq.: 3.700, 14.050, 14.270, and 3.885. Send SASE for a certificate to *Ray Knuth KB8ZYY, P.O. Box 271, Oscoda MI 48750 USA.*

AUG 13-16

SYCAMORE, IL The Kishwaukee ARC will operate W9S to commemorate the 42nd anniversary of the Northern Illinois Steam Power Show, from 1300Z August 13th to 1900Z August 16th. The four main frequencies are: 14.030 (CW), 14.250, 7.235, and 28.350. Stations contacted may request a certificate by sending a 9" x 12" SASE to *Bob Yurs W9ICU, P.O. Box 341, Sycamore IL 60178 USA.*

AUG 15

WILMINGTON, NC The Azalea Coast ARC will operate AC4RC 1500Z–2100Z, from the original radio room of the Battleship *USS North Carolina BB 55*. Freqs.: 7.250, 14.250, 21.35, 28.400. QSL to *AC4RC, P.O. Box 4044, Wilmington NC 28406 USA.*

AUG 15–16

WASECA, MN The Viking Amateur Radio Society will host their 3rd annual Special Event Station (WAØCJU/9ALD), honoring Edgar F. Johnson for his contributions to amateur radio. 9ALD was Edgar Johnson's call before Minnesota became part of the Ø call district. The station will operate in conjunction with the 3rd annual Hamfest/Swapmeet and a craft fair. There will be vintage E.F. Johnson AM, SSB, and CW equip. set up for hams to operate. A special certificate will be issued to all guest operators. A special QSL card will be issued to all hams who work the station. Vintage E.F. Johnson transmitters will operate on both SSB, AM, and possibly CW. HF operation will be between 0800 CDT–2100 CDT. Freqs. planned for use on AM are 3885, 7290, 14286, 21400 and 29000 kHz. SSB operation will be on 3900, 7260, 14250, 21350 and 28400 kHz. CW operation will be on 3700, 7125, 14050, 21150, and 28050 kHz.

AUG 15–17

ENGLEWOOD, NJ The Englewood ARA, Inc., invites all amateurs the world over to take part in the 39th Annual New Jersey QSO Party. For further details, contact (as soon as possible) *Englewood Amateur Radio Association, Inc., P.O. Box 528, Englewood NJ 07631-0528 USA.* Send a #10-size SASE for a reply. The contest will be held from 2000 UTC Saturday, August 15th to 0700 UTC Sunday, August 16th, and from 1300 UTC Sunday, August 16th to 0200 UTC Monday, August 17th. Phone and CW are considered the same contest. General call is "CQ New Jersey" or "CQ NJ." New Jersey stations identify themselves by signing "DE NJ" on CW, and "New Jersey calling" on phone. Frequencies: 1810, 3535, 3950, 7035, 7135, 7235, 14035, 14285, 21100, 21355, 28100, 28400, 50–50.5, and 144–146. The Englewood ARA suggests phone activity on the even hours; 15/10 meters on the odd hours (1500–2100 UTC); and 160 meters at 0500 UTC. Logs must show the UTC date and time, QSO exchange, band and emission, and be received not later than Sept. 12th, 1998.

AUG 22

NORTHPORT, LONG ISLAND, NY K2ARC, American Red Cross Emergency Communication Service will celebrate the 200th Anniversary of the Eaton's Neck Lighthouse, Northport, L.I., NY, in conjunction with participation in "Lighthouses on the Air." Operation will be on 7.280, 14.280, 21.380, and 28.380. For a special QSL, SASE to *CABNY-ARCECS DX Assoc., P.O. Box 1479, Huntington NY 11743.*

OXNARD, CA The Ventura County ARC will celebrate their 60th Anniversary of ARRL affiliation by operating Station K6MEP 0000 UTC–2400 UTC August 22nd. Operation will be on 28.340, 21.400 and 7.100. QSL to *K6MEP, P.O. Box 2103, Oxnard CA 93034 USA.*

SEPT 5

NOTRE DAME, IN Notre Dame ARC will operate ND1U 1600Z–2359Z Sept. 5th. to commemorate the 100th Anniversary of the First North American Wireless Transmission. SSB: 7.250 and 14.250. CW: 7.035 and 14.035. To obtain a commemorative QSL, send an SASE to *Notre Dame Amateur Radio Club, 226 COBA, University of Notre Dame, Notre Dame IN 46556.*

SEPT 12–13

VERVIERS, BELGIUM The G.D.V. "Gang de Verviers" of Verviers, Belgium, will again operate ON4USA, 1100 UTC–1700 UTC, Sept. 12–13. The operation will originate from the Henri-Chapelle Cemetery, Belgium, and all radio operators are encouraged to participate. Station ON4USA was formed in 1988 by Mr. Christian Keldenich in gratitude for their freedom which was gained more than 50 years ago. The station continues to operate on a yearly basis and many of the participating hams are bilingual, so language will not be a major problem. This event is conducted to honor the memory of those who gave their lives between 1939 and 1945 for the freedom of Europe, and to celebrate the liberation of the area around Verviers, Aubel, Welkenraedt, Hombourg and Henri-Chapelle, Sept. 9-12, 1944. CW: 7.040, 14.040, and 21.040. SSB: 14.225, 21.275, and 28.475.

NEVER SAY DIE

continued from page 5

field I see the reclusive lady slippers, a type of orchid.

A bird flies up from her nest in the field, scolding me. And I surprise some pheasants having an early lunch. In a whoosh they're away to the field across the dirt road. I jog over a little rise and there's a young fawn looking at me. When I get closer she turns and casually walks into the nearby forest.

Then I remember the thousands of days on the crowded New York subway, going to school and to work. I remember the car exhaust as I walked the sidewalks and the endless people, none smiling. The porno theaters and stores around Times Square.

School Daze

You're probably getting bored with me bitching about how our schools are doing such a rotten job of educating our kids — of how our youngsters are scoring right at the bottom of the developed world, with even the kids in Albania running rings around 'em. Well, golly, perhaps the NEA (the teacher's union) is right and we just need to spend more money. We need to raise teachers' salaries and thus get better teachers. Ya-da-ya-da.

Well, we're already spending far more per pupil than any other country, and our test scores are still dropping. I do like the solution to this problem: Lower the bar so more kids appear to have higher scores.

A look at the costs per pupil for K–12 shows that it has been going up fairly steadily for the last 45 years at a little over $1000 per decade ($108 per year), which has taken us from about $1600 per year in 1953 to $6500 this year. The fact that many parochial schools and schools like the Sudbury Valley School are doing a far better job of educating kids at less than half that isn't being mentioned.

A recent study showed that one third of the eighth graders in our public schools were unable to demonstrate a basic

Continued on page 71

Intro to Superhets

Part 1: History and overview.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

Early in the development of radio, a piece of wire bent in the shape of a hoop became a receiver. As such, it was placed in a strong magnetic field produced by a transmitter. The received signal produced a small spark between the ends of the wire hoop. A distance of a few feet between the transmitter and receiver was considered good.

To increase the distance, a more sensitive receiver was developed by using a rectifying junction. Materials such as oxides and carbon were tried. Each produced a sensitivity that was reasonable but still not good enough. Later, a mineral called galena was found to produce an even better sensitivity. This was the age of the crystal set, and because of the better sensitivity, the distance between the transmitter and receiver could be increased.

Crystal sets were expensive and only a few people could afford them. At the time, it was common for people to gather around the set and share headphones so that they might hear a program. The choice of program listened to was determined by which one could be heard. A selection was not possible at the time.

Later on, when more stations began operating, an interference situation developed. The need to select a desired station began to grow. Tuned circuits were developed, and helped to a degree. However, at that time impedance matching was either unknown or not understood because the impedance of the crystal detector was seldom matched to the impedance of the tuned circuit. Poor sensitivity and very broad bandwidth were the result. With the advent of the vacuum tube, impedance matching became easier. This was especially true after the development of the triode tube.

Better receivers were sought, and by using the triode tube, many detector circuits were developed. At first the tube only replaced the crystal as a rectifier and produced only a negligible increase in performance. However, the triode, when used in detector circuits such as the grid leak, infinite impedance, plate, regenerative, and many others, produced results which delighted everyone. At first it was thought that sensitivity and selectivity had reached their peak. This idea was short-lived, because as the number of transmitters increased, so did the number of remote listeners and interference problems.

Tuned radio frequency (TRF) amplifier stages were added to the receiver, shown in **Fig. 1**, ahead of the detector to improve both the sensitivity and selectivity. As each tuned circuit was added, so was a knob on the front panel to tune it. To tune in a station on one of these receivers, which had five or six RF stages, it was necessary to be an octopus. If all the circuits were not tuned to the same frequency at the same time, the sensitivity would drop off so rapidly that a station could be bypassed without knowing it.

Great strides were made in the radio business when companies like Atwater-Kent ganged the tuning capacitors together with steel bands or wire to synchronize the tuning of each circuit with a single knob. This was called gang tuning and was hailed as a major development.

To better this arrangement, companies like Majestic mounted many tuning capacitors on a single shaft, which eliminated haywire and steel bands—for a while, that is. Wire and string returned to receivers, not to gang capacitors together, but to synchronize a big dial to the tuning capacitor. The price of receivers was then determined by the number of tubes and the size of the tuning dial.

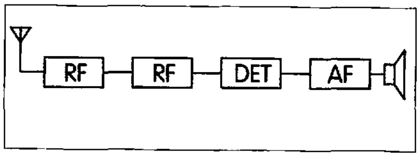


Fig. 1. A TRF receiver with a detector preceded by two RF stages.

Even though receivers became fancier and higher-priced, the problem of interference still continued to mount. In 1932, Edwin Armstrong developed the superheterodyne receiver. This receiver was the answer to most all of the existing receiver problems, and even today, the superhet receiver is still used. However, the circuitry has been refined and updated through technology. A single conversion superhet following Armstrong's original design is shown in **Fig. 2.**

The word superheterodyne seems to be a coined word for the era of its development. However, the word heterodyne describes the principle of operation. When two signals, whether audio or radio frequency, are mixed together, beat notes are produced. These beat notes are the sum and difference combinations of the principal input signals. Musicians use the heterodyne principle when tuning a stringed instrument. By plucking two strings simultaneously and then a third string, beat notes are produced. The third string can be tightened or loosened to produce the desired beat note.

Because the bandwidth of a tuned circuit becomes narrower as its tuned frequency is reduced, the ability of the circuit to select a particular signal is improved. The disadvantage for the TRF and crystal set was that there was very little control over the receiver's bandwidth except through the use of multiple tuned stages.

To get around this problem, heterodyning was introduced, allowing the input signal to be at one frequency and the frequency selective circuits within the receiver to be at another fixed frequency. As shown in **Fig. 3**, a signal arriving at the antenna of the receiver at 2 MHz can be converted to a frequency of either 1 MHz or 5 MHz by beating it against a signal at 3 MHz. If selectivity improvement is desired, then the heterodyned frequency of 1 MHz would be chosen. The 5 MHz signal is higher than the original 2 MHz signal and, therefore, the tuned circuits would exhibit a wider bandwidth. The 3 MHz signal is called a local oscillator (LO) signal because it is produced within the receiver for the purpose of heterodyning it with an incoming signal. Because the result of this heterodyning produces a new signal (1 MHz), this new signal is called an intermediate frequency (IF) signal. An IF amplifier is fixed tuned to the desired frequency.

Of course, there are other important circuits in a receiver to improve both the sensitivity and selectivity. It is also necessary to consider noise reduction from the many sources that surround a receiver. Let's now examine and discuss each stage of a receiver to provide some insight into its function.

Front end

The receiver front end consists of those stages existing between the antenna terminals and the input to the IF amplifier. Front end stages are the RF, mixer, and oscillator. It is generally assumed that a circuit must be an amplifier to be called a stage. In actuality,

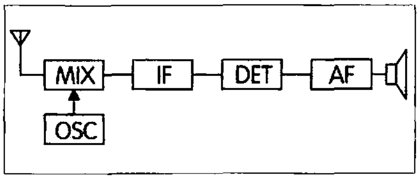


Fig. 2. Single conversion superheterodyne receiver.

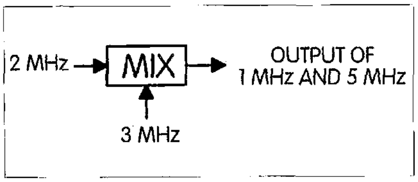


Fig. 3. Two fundamental signals being mixed, producing sum and difference beat frequencies.

the oscillator is not considered a stage, but only an oscillator section. For instance, a power supply is not an amplifier and it is rarely, if ever, called a stage. These circuits are usually referred to as sections, such as the power supply section, oscillator section, noise limiter section, and so forth. However, the term "stage" is used rather loosely at times and has become acceptable in most circles.

Front end circuitry becomes the real heart of the receiver and is the determining factor in its success as a listening device. Some factors involved are sensitivity, selectivity, noise figure, and image rejection. Noise figure is frequently a measure of sensitivity as a signal level compared to a received noise floor. Unfortunately, there is no formula which will satisfy all of these factors at the same time. A compromise at times, however, will satisfy most situations. To a degree, all of these factors tend toward the same requirements in circuit design and may be considered a "formula."

For a receiver to be sensitive, it must be able to respond to weak signals. How weak must the signal be to be called weak? The term sensitivity then is relative and is tied to the state of the art receiver sensitivities. At present, a sensitivity of 0.1 microvolt for 10 dB of quieting is about average for VHF and UHF receivers. Low-band receivers in the 400 kHz to 50 MHz region perhaps require only two microvolts for 10 dB of quieting. The difference in the frequency range versus the sensitivity is determined by the amount of atmospheric noise present at the antenna terminals of the receiver.

Maximum atmospheric noise seems to be centered on 25 MHz. Fortunately, atmospheric noise decreases at the rate of 3 dB per octave for increasing frequencies. Therefore, VHF and UHF frequencies are less bothered by atmospheric noise. Of course, atmospheric noise is not the only noise which must be overcome in a receiver. Noise caused by the thermal agitation of electrons as they bump into things becomes quite predominant at times. Vacuum tubes and early semiconductor devices produce a wonderful amount of noise. Today we use noisy diodes as a noise source for testing receivers.

When a tremendous amount of amplification takes place following a noisy stage, all of the noise produced by that stage will be amplified along with any signal which is present. If the signal is weak, the noise may mask it. Also, when the signal is strong, it may mask the noise. When an engineer designs a receiver, he must consider every factor carefully so that a receiver will be produced which will provide the best capabilities possible at minimum cost. Considerations must be made for the front end stages to provide a suitable signal-to-noise ratio, ample adjacent channel signal rejection, etc.

So far, sensitivity has been the major point in the discussion, although bandwidth has been mentioned. Generally speaking, the wider the bandwidth of the front end, the greater the amount of noise that will enter. Therefore, narrow bandwidths are desirable. In addition, narrow front end bandwidths tend to reduce crosstalk (modulation of the incoming carrier by a strong adjacent channel signal) and images. However, the major contributor to crosstalk is any nonlinear device within the receiver existing in the early part of the signal path.

An image signal is caused by heterodyning action. Since superhet receivers use heterodyning for frequency conversion, image rejection becomes a problem. All superhets are plagued with this condition. However, better receivers reduce the problem by using many high-Q tuned circuits in the RF stage and by frequency conversion techniques. An image signal is usually an interfering signal, which enters the receiver front end outside of the normal passband of the input circuit. It is usually just the right frequency to beat with the local oscillator to produce a signal equal to the IF. As such, the IF amplifies and passes the signal as if it were the desired input signal. Once the signal enters the receiver, it cannot be rejected. It must be kept out in the beginning. We will include a further discussion of images when we talk about mixers and oscillators.

RF stage

The RF stage design is generally chosen for the receiver's application. For instance, if the receiver is to be used for FM music or local signals which are generally very strong, the RF stage requirements are reduced to perhaps none. It may also be designed as a passive (nontunable) stage with a passband wide enough to cover the desired band. However, when the receiver is designed for communication in the VHF and UHF region, the front end design becomes critical as the typical signal is very weak and easily masked by noise and adjacent channel interference.

The gain of the RF stage is of secondary importance when compared to signal-to-noise ratio, which is a measure of sensitivity. The purpose of the RF stage is to provide only enough gain to present a signal to the mixer at a level above the noise level generated within the mixer. Although a high gain sounds desirable, it comes at the cost of increased noise generation as a function of gain. Typically, the RF stage provides only slightly more gain than required to overcome the insertion losses of the tuned circuits preceding the stage.

When transceivers are used in a duplex mode (transmitter and receiver operating simultaneously), the receiver is subjected to having a high level of RF energy being present at its antenna. Even though it isn't at the same frequency, the high RF level can cause a masking of the received signal, particularly if weak. The condition is called "desense," where the receiver is desensitized as a result of the strong local signal. Clearing up the desense problem requires many techniques, including filtering, a nonsaturating RF stage, and signal separation (narrow pass-

band). Duplexers, high-Q cavities, and helical resonators are common in base station and mobile equipment where the transmitted signal level must exceed the received signal level by 60 dB because some desense is still noticeable at 60 dB.

Mixers

The second most important stage in the receiver is a mixer. During the frequency conversion process, noise is generated. The level of noise must be kept to a minimum. The mixing process is usually the noisiest within a receiver and that noise level must be overridden by the incoming signal from the RF stage. Therefore, the RF stage must have a noise figure less than that of the mixer, yet have just enough gain to provide a signal level exceeding the noise level of the mixer.

The mixer stage of a receiver is not generally required to exhibit gain, since the achievement of gain embraces the generation of noise and is to be avoided when possible. Many mixer designs have been developed over the years, starting with diodes being the first in a series of nonlinear devices. Because of the inherent noise generation within a mixer, many designs have been used with low-noise vacuum tubes, transistors, JFETs, and now balanced mixers. Balanced mixers may be made using active and/or nonactive (passive) devices. The objective of using a balanced mixer is to reduce intermodulation distortion, and modern passive balanced mixers have a large dynamic range which prevents them from creating signal distortion during the presence of strong signals whether local or adjacent channel.

The purpose of a mixer is to act as a nonlinear device to distort the waveform of the incoming signal. Consider what a halfwave rectifier in a power supply does to the sinewave input from the power line. It distorts the signal by conducting on only one half-cycle of the waveform. The mixer does essentially the same thing to its input signals. Because of the distortion, combinations of the various input signals are produced and only the desired combination is selected for use. Without this distortion generator (mixer), frequency conversion would be difficult.

Images

Because of heterodyning action, images occur. What is an image? As a result of mixing a local oscillator signal with all of the signals appearing in the antenna circuit, there will be two product signals that will be adjacent to the oscillator and separated by a frequency equal to the IF. One of these signals will be oscillator frequency plus the IF, and the other will be the oscillator minus the IF. As **Fig. 4** shows, the difference between the two input signals is twice the IF. One of the two signals will be the desired signal and the other is the unwanted signal, or image. It is called an image in comparison to the desired signal, which places it in a mirror-image position relative to the oscillator.

As an example, if the oscillator is at 10 MHz and the IF is 2 MHz, then the #1 signal will be 2 MHz less than 10 MHz, or 8 MHz. At the same time, #2 is 10 MHz plus 2 MHz, or 12 MHz. A signal arriving at the antenna terminals at either or both 8 and 12 MHz will be mixed with the oscillator and converted to 2 MHz. Either of the two signals may be designated as the desired one, and the other is then called the image.

To reduce the strength of the image, tuned circuits resonant at the desired frequency must be used between the antenna terminals and the mixer. The greater the number of resonant circuits or circuits exhibiting a high Q, the more the image will be attenuated.

Another way of attenuating the image even further is to increase the frequency separation between signal #1 and signal #2. This is done by increasing the frequency of the IF. The greater the separation, the easier a low-Q circuit will reject/attenuate the image. Two techniques typically used to reduce the image are increasing the number of tuned circuits or Q of the tuned circuits between the antenna and the mixer, and utilizing multiple frequency conversion.

Next time: oscillators, IF amplifiers, detectors.

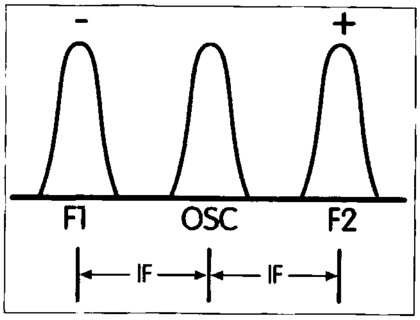


Fig. 4. Desired and image signals created through heterodyning. Desired and image signals are separated by two times the IF.

73 Review

Whiterook's Model MK-88 Pocket Electronic Keyer

If CW is for you, check out this keyer.

Thomas M. Hart AD1B
54 Hermaine Ave.
Dedham MA 02026

Morse code is the oldest amateur mode and is composed of unmodulated RF. The first Morse code transmitters sent noisy electronic pulses with signal strengths that changed during transmission. The "damped wave" of early designs was replaced in due course by the constant output levels of tubes. The term "continuous wave" (CW) refers to the generation of RF on a single frequency at a continuous strength.

The actual code is named after Samuel F.B. Morse, an American artist and inventor, born in Massachusetts in 1791. Morse was a prominent painter and sculptor who graduated from Yale and became a professor at New York University by 1832. He had other interests, including communications. In 1837, Morse invented a system for message transmission over a single wire using an electrically pulsed code. Early systems used electromechanically-controlled pencils to mark paper strips driven by clockworks and were effective at distances up to 20 miles; relay stations ultimately increased system range. Operators soon realized that they could copy "by ear" and that the recorders were unnecessary. In time, other investigators, including Thomas Edison, improved the technology so that multiple signals could be sent on a single wire. By using alternating current on different frequencies, many signals could be in process at any given time. Filters were then used to send messages to specific receivers for decoding.

About two years ago, I discovered the RS-12 satellite and began to use it for communications. Both SSB and CW modes are available on modes K and A on this particular satellite. It had been quite a while since I had used a straight key or keyer. My computer and terminal unit have done most of my CW in recent years, and then, mostly during contests. My venerable Ten-Tec™ keyer had long since stopped working and I was on the search for something new.

I started with no idea what might be available or how much I could expect to spend. In fact, the costs of most units were appalling. I wanted to make a few satellite contacts, not invest in a blue-chip keyer. It seemed that mechanical keyers had largely disappeared from the scene, with the notable exception of the Vibroplex™ Classic—a beautiful unit, but one that did not come close to fitting into my cost/benefit curve.

Then, I saw an advertisement for Whiterook Products, a company owned and operated by John Roblin WA6KYO. I sent for a catalog. Whiterook offers a variety of keys and keyers, the latter in single- and double-lever versions. I now have two MK-88 keyers and am very pleased with both.

What is an iambic keyer?

The term "iambic" denotes a two-syllable metrical foot, where the first syllable is unaccented and the second accented. In short, a term with the emphasis in a "di-*dah*" fashion. In practical terms, iambic keyers feature two levers that are used in a "squeeze" fashion to facilitate use. Iambic keying operates in two main fashions, mode A or B. The latter is far more common, and is designed to allow the user to insert dits or dots while keying a string of the opposite element. Sounds confusing, but it works great. The current Whiterook MK-88 is exclusively mode B.

Iambic keyers allow the user to press one lever for a series of dots and the other for dashes. The special feature of the system is that when both levers are pressed, the keyer alternates between dots and dashes, very convenient for generating CW. There are memories in the chip design that hold the inserted dit or dot and then send it at the right time. Keyers are especially useful in generating the so-called

"iambic seven" characters: C-F-K-L-Q-R-Y. Use of alternate paddles makes keying quite effortless, although there is a learning curve to overcome. Iambic keyers are much more user-friendly than the older single-paddle "sideswipers."

Integrated circuits: the keyer brain

Older versions of the MK-88 (and many other keyers, too) used the Curtis 8044ABM integrated circuit, which is no longer in production. An exact substitute is the Island Keyer chip, a 20-pin "keyer on a chip" that has a 50 μA resting current and good RF immunity. An external 50 to 500 μA meter can be used to monitor code speed during operation. Contact debounce is minimized, characters are self-completing and weight control is available. Dot and dash memory is part of the chip design as well.

Model MK-88

The Whiterook keyer is capable of speeds of up to 40 wpm, but most of us will never approach speeds that high (maximum wpm is 20 to 30 in most cases). The case is black ABS plastic and the entire unit is small and light. There is no provision for external power, but there is enough space inside to change that. As shipped, the keyer uses a single three-volt lithium battery (included); replacements are available from Radio Shack™ and other electronics stores. The output goes to a 3.5 mm jack mono connector that is designed for positive-keyed (i.e., switched to ground) solid state rigs. The unit was targeted at the QRP market, but I have used it with power up to 160 watts from 80 to two meters.

Whiterook cautions that high power transmitters may interfere with the keyer because the case is not shielded. I have not experienced problems while operating at medium power levels (up to 160 watts) except on the 160 meter band. For some reason, I have enough RF in the shack to lock up the keyer when running 100 watts on 1.8 MHz.

The mechanical system is plastic and is not as rugged as metal counterparts offered by Kent, Bencher, Vibroplex, MFJ and others. However, careful use should eliminate any short term system failure due to materials. There is no way to adjust the gap, an absence that may not be desirable to some operators. When used as a single lever system, the dot and dash levers are "sideswiped" as needed. The only problem that I have noticed here is that if one lever is not completely released, or accidentally brushed, strange combinations of dots and dashes may result. The non-iambic operator has to develop a feel for the keyer; a soft touch is required.

It is very interesting to operate the keyer and find that it is absolutely silent. There are no relays or other gadgets that let you know what you are sending. A sidetone in the rig is necessary. One change from earlier versions of the MK-88 is the addition of two red dots; one on the thumbwheel that acts as on/off switch and speed control, and one on the case. The dots remind you that the key is off when they are lined up next to each other.

I feel that the Whiterook MK-88 is a fine product that will meet the needs of many CW operators. Hard-core Morse coders will probably want something more upscale, but portable, QRP, and occasional operators will appreciate the price and features. The unit is very light and must be treated carefully. Do not plan on putting a brick on top to hold it in place while you operate.

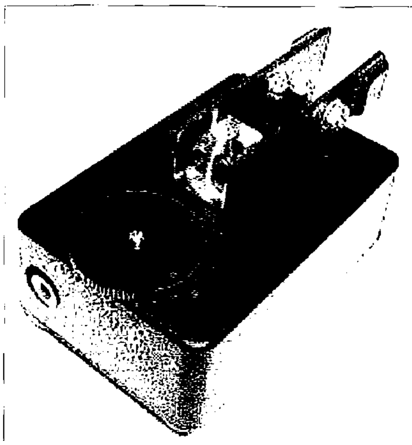


Photo A. *Whiterook's MK-88 Keyer.*

Whiterook offers the MK-88 for $59.95 plus $2.00 shipping and handling. Order it by mail from:

Whiterook Products Company
309 S. Brookshire Ave.
Ventura CA 93003-4413.

You can also order by phone/FAX at (805) 339-0702, or by E-mail at [wpc@west.net]. Don't forget to check the Web site at [http://www.west.net/~wpc].

Experimenter's Power Panel

Reduce the hassle (and the risks) of haywiring—and encourage exploration in electronics.

Marion D. Kitchens K4GOK
2709 Colt Run Road
Oakton VA 22124
[jkitchen@erols.com]

Hams who enjoy experimenting with electronics projects are in constant need of various voltage supplies that are readily and easily accessible. Most common needs include five volts at a few amps for TTL and similar circuits, nine volts at less than one amp, and a 13.8-volt high current supply. The power panel described here provides those voltages right at the workbench.

This power panel is one that has evolved over a number of years, and therefore includes those features that have proven most useful for me. They include a digital voltmeter for monitoring the regulated panel voltages, as well as for measuring external voltages such as circuits under test. External voltage measurements from 200 millivolts full scale up to 200 volts full scale are accommodated, with 10 megohm input impedance.

All regulated voltages have front panel On/Off switches and heavy-duty binding posts suitable for banana plugs or direct wiring. Green, yellow, and red LED indicators make it easy to tell at a glance which voltages are active and which are not. The five-volt supply delivers up to three amps, and the nine-volt supply can deliver considerably more than needed for most needs—up to about 10 amps.

There are no critical or fussy circuits. All parts are readily available from several sources, including many hamfests.

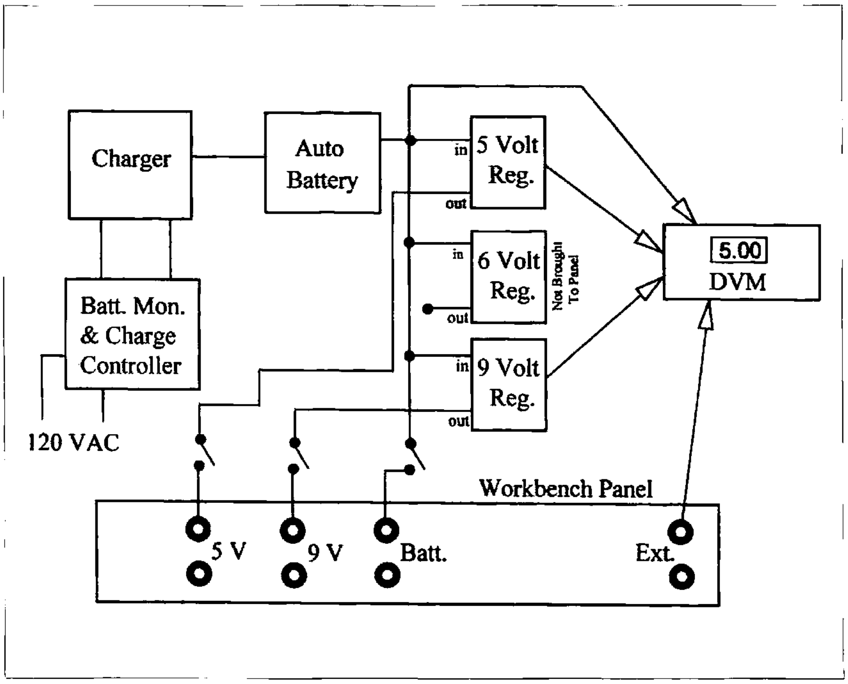


Fig. 1. Block diagram.

Circuit description

Fig. 1 shows the basic elements composing the power supply and panel.

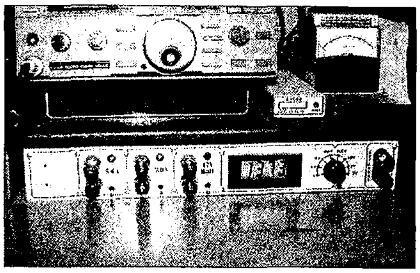


Photo A. Power panel in its operating location.

Photo B. Power panel battery and charger.

Note that it starts with an automotive battery under the workbench. The battery is kept charged by the Battery Monitor and Charge Controller described in the June 1995 issue of *73 Magazine*. **Photo A** shows the Battery Monitor and Charge Controller on the shelf just above the power panel.

Photo B shows the battery and its simple charger. The charger schematic is shown in **Fig. 2**. It uses a common full wave rectifier circuit from a 30 VAC, center-tapped transformer. The 1 Ω resistor limits the output current to prevent overloading the transformer and diodes when charging a low battery. Note that a voltmeter across the 1 Ω resistor can be used to indicate the current—one volt equals one amp of current.

The 13.8-volt supply is simply the auto battery, whose voltage varies depending on the battery's charge state. **Fig. 3** shows the schematics for the nine-volt and five-volt regulators as constructed. Note that the five-volt regulator gets its input from the nine-volt supply. That arrangement reduces the power (heat) dissipation required of the five-volt regulator since it operates from only nine volts instead of the full 13.8 volts of the battery. This arrangement also requires the nine-volt supply to deliver the full three amps delivered by the five-volt regulator, plus any current drawn from the nine-volt supply directly. The LM317 is limited to a maximum current of 1.5 amps; hence the current-boost 2N3055 transistor in the nine-volt supply. The 190 Ω and 82 Ω resistors help stabilize the output voltage of the nine-volt supply. Their values are not critical, so any value close to those shown should work equally well. The particular LM223 five-volt regulator on hand

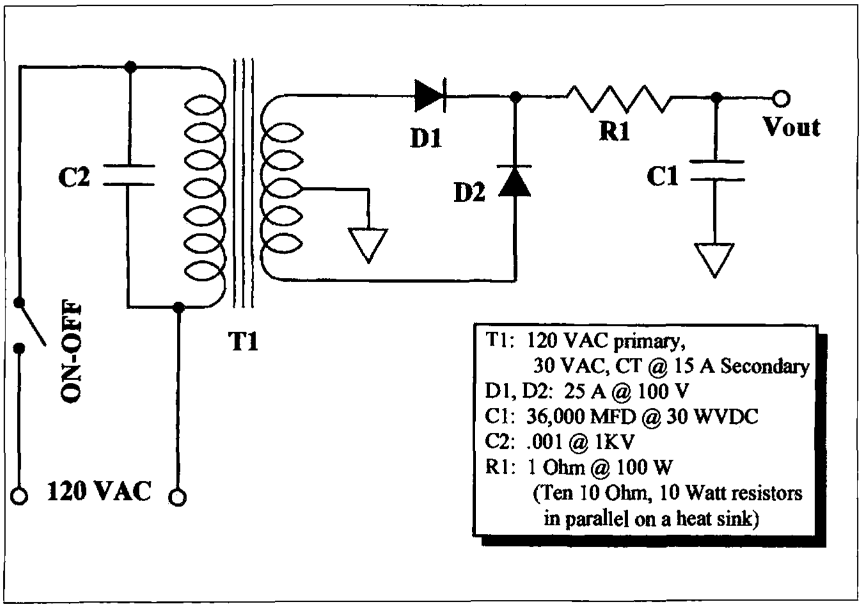
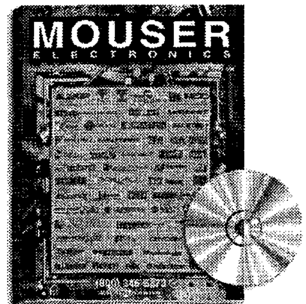


Fig. 2. Battery charger schematic.



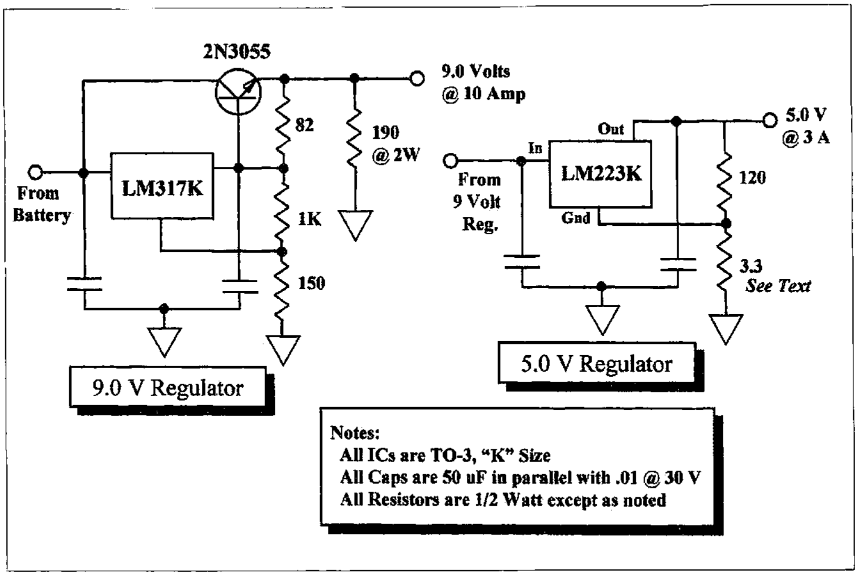


Fig. 3. Nine- and five-volt regulators.

had an output voltage that was lower than desired, so it was "trimmed" to be closer to five volts by use of the 3.3 Ω resistor and 120 Ω resistor shown in the schematic. If your LM223 output is sufficiently close to 5.00 V, put a short across the 3.3 Ω resistor, or replace it with a piece of wire.

The digital meter module is one of those "can't measure its own voltage" types available from many mail order houses. It is powered by a separate "wall wart" nine-volt DC transformer.

Fig. 4 shows the digital voltmeter switching, resistor dividers, and associated components. The three 200k calibration pots should be adjusted by (1) measuring the regulator output voltages with a known accurate DMM, and (2) adjusting each pot so that the panel meter reads correctly. Note from **Fig. 4** that the battery voltage to the panel meter is not switched on and off as are the five-volt and nine-volt regulator outputs. That way, the panel meter monitors the battery voltage any time its selector switch is in the "Batt" position.

Construction

The front panel is made from 1/8-inch-thick PCB material. Painting and labeling are as shown in the photos. The panel is mounted to the workbench via small 90° angle aluminum brackets.

The charger construction is rather straightforward, with one exception. That exception is the 100-watt, 1 Ω resistor, which is made up of ten 10 Ω, 10 W resistors all wired in parallel and epoxied to a five-inch by six-inch piece of 1/8-inch-thick aluminum for heat dissipation. Point-to-point wiring is used throughout the power panel construction, as well as the battery charger.

Regulators are set in large heat sinks and then mounted as individual units underneath the workbench, as shown in **Photo C**. All the electronics associated with each regulator unit are mounted directly at the regulator ICs. The five-volt and nine-volt regulators are shown in the foreground of the photo. The third heat sink and regulator in the background is for a six-volt supply. This six-volt supply has proven useful in powering older equipment such as six-volt relays and coaxial switches designed for older automotive use—these are often very inexpensive at hamfests. Most experimental circuits do not use six volts, so that supply was not brought to the workbench panel.

The voltage dividers and switching for the digital meter were assembled on a small perfboard installed behind the benchtop panel. **Photo D** shows

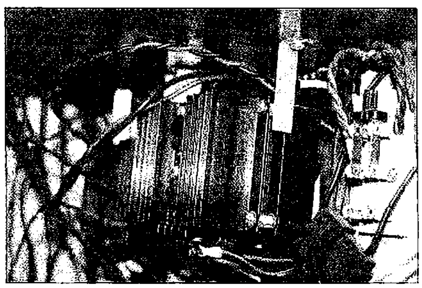


Photo C. Regulators and heat sinks under the workbench.

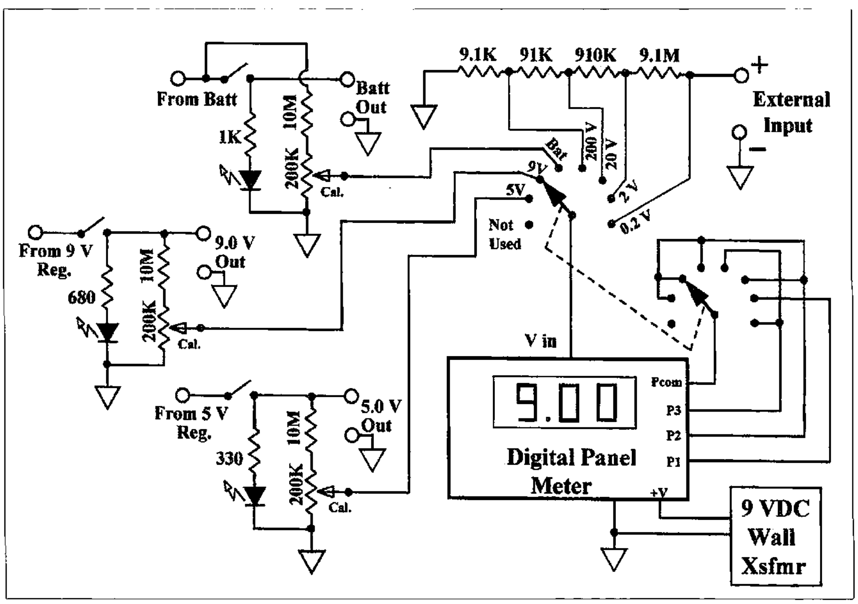


Fig. 4. Switching and voltage divider wiring diagram.

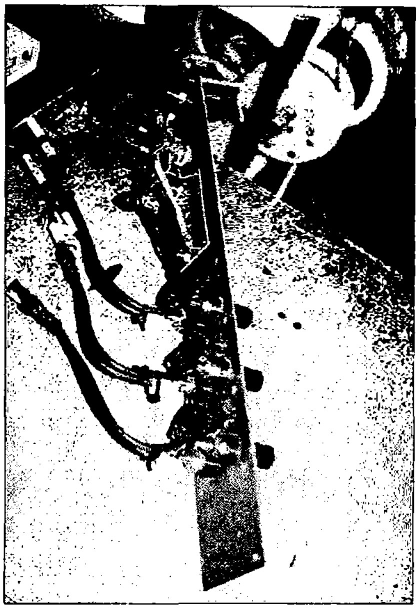


Photo D. Wiring behind the front panel.

the perf mounted on the back of the rotary switch. Note the heavy #10 wiring used to bring the power to the workbench panel. This heavy wiring from the regulators reduces voltage drops when a few amps of current are drawn.

Other output voltages

Fig. 5 shows the necessary information for designing regulators for any desired output voltage. When using **Fig. 5**, follow the equations from left to right, through "A" to "B" to "C" for your particular needs. Be sure to check the required power dissipation of the components used in your regulated supplies, and provide adequate heat sinks. A first approximation of the power to be dissipated in a regulator IC is:

Power = (Supply Voltage - Regulated Output Voltage) x Output Current.

Keep in mind that most TO-3 regulators are limited to about 20 watts, and that assumes they are in adequate heat sinks.

My schematics were based on the components on hand at the time of construction. The components determined the specific circuit designs. Other regulator circuit designs are frequently used, and are described in publications such as the *Voltage Regulator Handbook* (National Semiconductor, 1975). I encourage you to use components you already have or can find readily at hamfests.

Future additions

Note the unused space on the left side of the power panel. That space is reserved for future installation of the next-most-needed supply—a variable voltage source. For some analog circuits (op amps and the like), a dual-ended supply (plus and minus voltages) is often needed. So that reserved space just might be used for a variable voltage, dual tracking regulator. But that's forecasting the future, which is beyond the intended scope of this article.

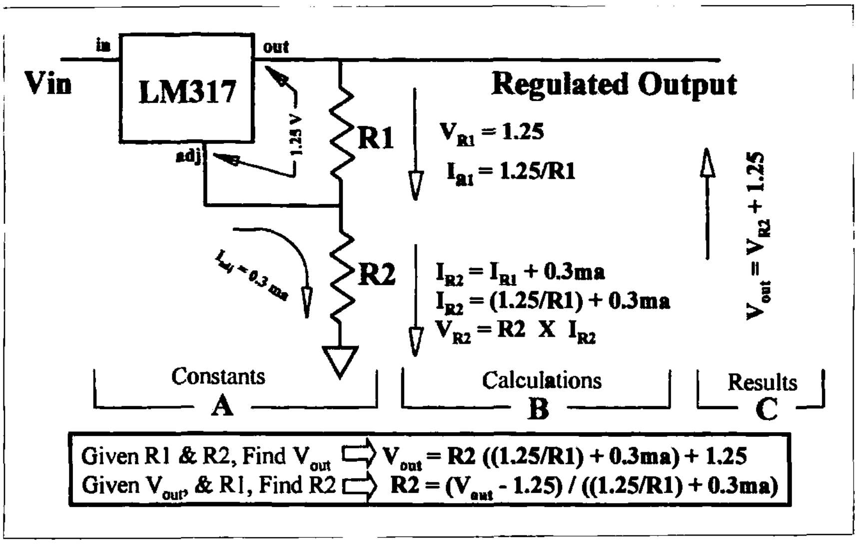


Fig. 5. Designing other regulators.

An FET Probe to MMIC

How about some (well, relatively) new technology for your test bench?

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

If you experiment as much as I do, you will have occasion to need a high-impedance probe having some gain for use ahead of an oscilloscope, counter, or high-frequency voltmeter. It may also be used as an RF sniffer for detecting the presence of RF on resonant circuits. The probe has a frequency range from about 20 kHz to 500 MHz, and an output impedance of 50 ohms—which makes it usable over most of the ham bands. The general specifications for the probe when using an NEC UPC1651 MMIC and MPF-102 JFET are:

E_{in} = 15 V_{p-p} max
Z_{in} = >100 k
Z_{out} = 50 ohms
V_{cc} = 3–5 V
F = 20 kHz to 500 MHz
gain = >10 dB.

Here is the story about how the FET probe came into being. A while back I ran across an NEC UPC1651 MMIC (monolithic amplifier) and at first had difficulty in using it. But as a true experimenter, I began designing circuits around it to see what it would do. Failures seemed to prevail over successes until I realized that the input and output impedances were 50 ohms.

From that point on, things improved. The projects ranged from the FET probe to stripline amplifiers. So far, the FET probe has proven to be the most useful application because it has provided an increased input sensitivity to the supporting equipment. The equipment is "pushed" to respond to lower signal levels and slightly higher frequencies than it would normally support. What this means to the experimenter is that his equipment can be extended sufficiently to provide indications not previously possible.

Construction of the FET probe is straightforward with no surprises. The prototype was implemented with the NEC UPC1651 and the results are shown in the first paragraph above. Although I did not try one personally, a Mini-Circuits MAR-1 or MAR-2 (and perhaps other versions, too) should work equally well and should meet the specifications shown.

There are minor differences in the device configurations which are shown in **Figs. 1** and **4.** Both the circuit and

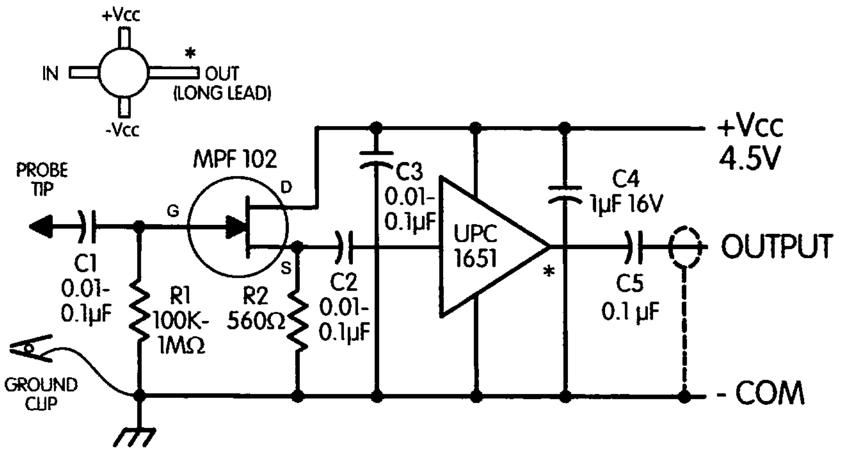


Fig. 1. Schematic of FET probe using an NEC UPC1651 MMIC.

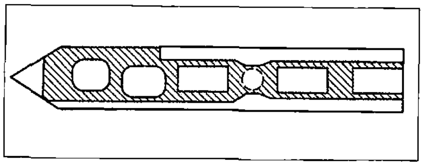


Fig. 2. Single-sided printed circuit board layout for the NEC UPC1651 FET probe.

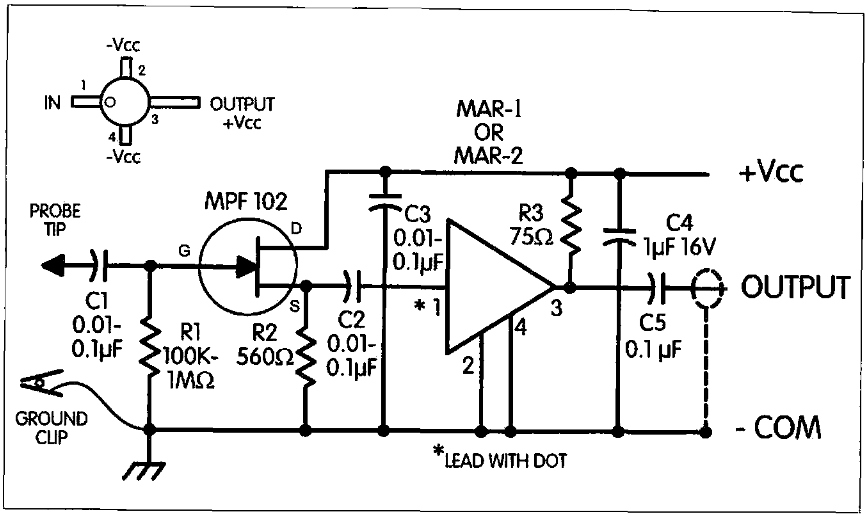


Fig. 4. Schematic of FET probe using a Mini-Circuits MAR-1 or MAR-2 MMIC.

the board layout for each MMIC are shown, to provide you with construction options. The UPC1651 has one long lead which designates the output. Internal biasing is obtained through another terminal. The input and output terminals are on opposite sides of the device and require only coupling capacitors to the adjoining circuits.

When using a MAR device, the output terminal must be biased externally. Typically, a series-connected inductor and resistor are used with the MAR device. However, in the FET probe application it might be best to use only a 75-ohm resistor. It has been found that 1/4-watt carbon resistors in the 50–100 ohm range tend to be non-inductive and work well in RF circuits. An inductor, if used, would tend to peak the response at some frequency when a flat probe response is preferred.

To obtain a high input impedance, a JFET connected as a source follower was used as an input stage. Although little or no experimentation was done in selecting the 560-ohm source resistor, suitable probe results were obtained. However, the source resistor value may be adjusted as required to improve the match between the FET and the MMIC to achieve a better or different response. In other words, the design lends itself to experimentation and improvement to meet the user's needs.

Again, and although my FET probe was implemented with an MPF-102, other JFETs, such as 2N5245-48, 2N4416, etc., should perform well as they were designed to operate in the 400–500 MHz region. Since the MMICs are designed to operate up to about 1000 MHz, the FET will be the frequency-limiting factor.

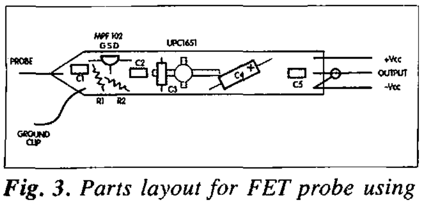


Fig. 3. Parts layout for FET probe using the NEC UPC1651.

I built my probe on a strip of single-sided 1/32-inch glass circuit board which is narrow enough to fit inside the shell of a Sharpie® marking pen, but the probe works well without a cover should you choose to operate it that way. The parts are mounted on the copper side of the board to keep lead lengths to a minimum and not require any holes—except, that is, for a 3/16-inch one to provide clearance for the MMIC body so that the terminal leads will lie flat against the board. If it is necessary to cut the MMIC leads, care must be taken to retain the lead orientation, particularly on the UPC1651.

Component leads were formed to lie flat and are soldered to the copper traces. Chip capacitors were used for coupling and small axial lead caps were used for the 1 µF and 0.01–0.1 µF V_{cc} bypass caps. The two axial-lead capacitors are skewed to fit inside the envelope of the pen shell.

One-eighth-watt resistors may be used in the 100 k to 1 meg and 560-ohm resistor locations, but the 75-ohm used with the MAR device must remain as a 1/4-watt carbon to achieve the flat frequency response. The circuit board layouts shown in **Figs. 2–3** and **5–6**

Continued on page 78

Number 50 on your Feedback card

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

The pursuit of test equipment and other junkyard acquisitions

Even better, this month's column should be labeled, "Confessions of an Electronics Junkie." It might provide some revealing confessions and realizations on what insight is involved in purchasing and picking out equipment to put in our ham shacks.

Let's open the doors to reality and look at a variety of deals made to pick up test equipment. Sure, we all would like to have the very best in frequency counters, signal generators, o-scopes, and such for use when the need arises. That's why we are junkyard *aficionados*. We try to get the best deal we can on a limited budget. The want list does not stop at just simple items, but can get quite involved when the lack of logic and reason hinders our judgment. Deep pockets and lust for a particular item need to be balanced by a swig of Kool-Aid™ and a bit of self-realignment and evaluation.

Actually, if your purchases resemble mine, you too have become quite a collector of various pieces of test equipment which you've picked up as bargains during a hot flash of "pickupitis," only to find out later that your bargain turned out to be something less desirable on closer (and cooler) evaluation. That's why we want to advise you about our experiences—so that you can avoid diving into a new money pit. In other words, picking up something that someone just passed to you which has a problem they could not fix—or did not want to—and so they made a get-rid-of as-is sale.

I don't want to say every deal out there is bad, but here are some pointers from my experience. There *are* some bargains out there—just evaluate them without the "hot blood flowing" if you can. That's the point of the column this month—to describe some of the bad decisions I have made in purchasing "bargain" test equipment—things I paid good money for, and which, I can now admit, make great doorstops.

Don't get me wrong. Collecting parts and pieces towards a well-stocked junk box is admirable and has saved quite a bit of money for all of us. It's just that when we need a D9 Caterpillar™ bulldozer to *move* the junk box, it's time for another approach. It's great to save old parts, but I have become very aware that holding on to old AC power transformers from TV sets and bags of parts removed from PC boards can be detrimental to movement about the shack.

I might be getting a little fussy about parts and all the impressions that go with holding on to a large quantity thereof, waiting to acquire that certain piece of unobtainium to start a certain project. If you are as assiduous at collecting material for your junk box as I am, you too might benefit from reviewing priorities and storage space before spring—or summer—cleaning becomes a necessity.

Sometimes I lose my focus and start collecting material at a rate that makes it seem that my goal is to be one of the major electronics suppliers—when most of the material I have assembled should be heading off towards a museum for proper use. For example, why did I pick up a rusty Hallicrafters S19 Sky Buddy HF receiver? I don't know for sure, but possibly it's because I had one in my very early years. Don't be discouraged at these words of disenchantment. Just read between the lines: We should be specific when assembling parts collections and make sure that they're something useful. Don't amass a collection that will not be put to use.

I have to admit that to be able to write these columns for quite a bit of time, lots of material had to be obtained and put to use so that I could focus more clearly on the subject. But sooner or later the pile in front of the workbench gets too high and impairs vision. It's not getting rid of good usable items, but instead taking a look at how much dust has collected on top of things and taking appropriate action.

I have been witness to other collections that have filled many old dresser drawers stacked one on top of another to hold parts, and I've wondered how anything could be found in the clutter. The same holds true for stacks of cardboard boxes in the garage, and I have to admit that it's also true for other personal storage areas. Something had to be done to refocus on parts that actually would be used and to get rid of my museum—either that, or charge admission.

Since annual cleaning has started taking place at my shack, I have disposed of about three pickup truckloads of material that was hard to give away. I guess the reevaluation of this material by someone who would take it off my hands prompted a rebirth in my thought processes on what is valuable and should be retained. This has led to a retention rule that is quite close to the truth. If it hasn't been used in a year or two you probably *won't* use it, so get rid of it.

I have been in the process of upgrading my test equipment for many years and have even picked up hangar queens of test equipment that I have made operational on the test bench. What is a "hangar queen"? Well, it's a nonfunctional piece of equipment that is used as a source of repair parts to facilitate repairs to your operational equipment when it crashes.

The premise of buying hangar queens is that this equipment is quite cheap because it does not function. It might have parts missing. The cost of a hangar queen, in most cases, is quite inexpensive when compared with the price suggested by the original manufacturer of the equipment. You probably will be shocked at the cost of new parts to repair old test equipment. What you have to do is determine for yourself what you can tolerate to store for "that day" when something breaks on your prime 15- to 20-year-old test sweeper or o-scope.

I have come to see that having repair parts is great if you have room to store them. In some cases, it might be better to obtain another test set. Of course, this depends on your area of the country and what has been available to use as a guide for future needs. In some parts of the country, test equipment is at quite a premium and all recommendations are quite void. The primary rule to follow, then, is that if it's reasonable and you can use it, pick it up even if it's a spare.

In looking for new and interesting material to write about, I've also run into many different electronic bargains that I did not need. If this piece of equipment is of the rare type that would be appreciated in a friend's shack and improve his test equipment, I usually purchase it on speculation that it will not be turned down by someone in our microwave group for cost. Don't go too far out on a limb, though. If it turns out to be bad, you're stuck with a great doorstop, so have a cushion either in the pickup price (usually with no guarantee) or take a phone number and let the

interested parties work something out, especially if it's pricey. The moral of this story is to bring a pencil and notepad to the swapmeet, at minimum.

Nearing the top of the list for things to bring to swapmeets is a small pouch of simple tools to test and evaluate some of the bargains you would like to examine to determine the likelihood of operability. Just a simple screwdriver to remove a top panel could have saved me the price and hauling home of a great piece of test equipment by revealing that the power transformer was cut off right at the windings' entrance to the core—making the unit worthless. Add AC power cords with both blade and round HP-type plugs to the tool kit for simple power-up checks.

I have even obtained some units that had all their internal circuitry removed—even though they looked just fine from the outside. Then there can be the other side of the coin, but this doesn't happen too often. I was offered two different items on different occasions. The first was a spectrum analyzer plug-in unit that had been on the shelf for many months, at a price that would dazzle you.

It seems that a third party had evaluated the unit and reported to the store owner that a big chunk of circuitry was missing from the inside of the unit. Because this was a valued customer, the information was accepted as gospel. A half hour or so later, in I walked. I was confronted by the plug-in on the display shelf. When I questioned the owner, he told me the tale and offered me the unit for a pittance of the original price. I picked up this "hangar queen" for almost nothing.

The upshot of this was that several months later when I finally obtained a mainframe into which to plug the unit to see what was missing, I was quite surprised—not only did it power up, but it functioned. Opening up the unit showed everything in place. Sometimes you win, sometimes you lose, but that day I won *my* version of the lottery.

The point here is to be careful in examining any piece of test equipment, even if it comes from good sources. A good rule of thumb is to turn it on, if the opportunity presents itself, and try it out. That's the sure method of testing. I cannot envision a reasonable seller who won't let you turn on and inspect anything he is selling, to show you it functions. It's protection for both you and the seller. The buyer knows what he is paying for, and the seller knows that his responsibility ends at the end of the driveway.

Both parties are served here in that the item for sale is not misrepresented. Most bargains are an as-is sale and can be tested in a simple test check. This is the best way of purchasing any item. Only big outlet merchandise or new equipment carries guarantees that can protect the buyer, but the price tags of new equipment are quite a bit higher than those for the used material that we are talking about here.

The other bit of advice that I wish to offer is this: Don't let your reason and emotions be overwhelmed by a deal that appears too good to be true. Yes, this can happen, but try to evaluate the situation and piece of equipment by looking at them from different angles. I remember that I just could not pass up a dual-voltage regulated current controlled bench power supply and could not figure out why everyone was passing it up. A deal (for me) made in heaven. I purchased it on outward appearances and was glad to do so at the time.

On arrival home, I looked at the AC plug and noticed that it was set up for European 220 AC power. Not a problem. I would cut the plug off and restrap the transformer to 110 AC. Ha! Was I in for a surprise! Not only did the transformer only have a single 220 winding, but it was sealed and I could not even probe it. The power supply was eventually used but at the price of using a large 1:1 transformer that happened to have a dual 110 primary. I connected the output 110 winding to the AC power (reversed from normal) and connected what was the dual primary into a 220 output tap.

It worked fine, and is in use to this day on my bench. Every time I look at that transformer on the extension power cord it reminds me of a snake that has just eaten a large rodent. Sure, it came out OK, but only with the external AC transformer. Watch your emotions, as well as what you purchase; it's not all a wonder world out there. There are lots of honest folks who have picked up something that needs a whatchacallit and haven't located one and are just trying to offer you a chance to find one to make that bargain piece of equipment function.

Future projects

N6IZW has started to try his hand at solving one of the common microwave test equipment challenges—a simple solution to the need for a microwave workbench power meter. Not everyone can afford or locate a suitable power meter to make measurements at our microwave frequencies. So this project is one that can be put to use in most amateurs' shacks using a computer for a readout. The plan is to make program calibrations on the curve of response allowing your home-constructed unit to be normalized by the computer. This, instead of comparing meter readings to constructed calibration charts. The project is still in the thinking stage, but it will be well founded on fact and prior experience.

Another project we would like to undertake is to come up with a simple SSB transceiver for use as an IF system for use with microwave converters. We are open to suggestions on this ambitious project and hope it can be pulled off to help those who cannot find a used two-meter multimode rig.

The two-meter rig is used as an IF amplifier in a microwave transverter. The multimode rig seems to be a stumbling block preventing many from getting into the microwave realm. New multimode rigs are quite expensive today and a used one can be hard to locate.

The last and final project is one that should be off the ground soon. I have received many requests to republish the plans and make available boards for a 30 MHz IF system for use with Gunn diode wideband FM transceivers for 10 GHz use. I might have to revisit the old PC board if I can locate a supply of TDA-7000 chips used in the IF amplifier. If there is time, I have a design for a compact amplifier using the same circuit but much smaller. The system would be quite a bit smaller, as the board size I am looking at is about two inches square. External to the main board would be the power supply modulator, which is essentially a voltage regulator and a single op amp used to voice FM modulate the adjust terminal of the voltage regulator.

I will try to get part of the system in an upcoming column. The whole project is dependent on getting PC board artwork ready to evaluate to see if there are any major errors. I always try to do my best in evaluation, as it seems that no matter how many times I look at a simple PC board there always will be an error or two that tries to get left in.

Well, that's it for this month. I hope to make some progress on the 10 GHz Gunn transceiver for next month. At least we will try to get the power supply modulator published, since this is such a simple part that it can be wired on a piece of perfboard. 73, Chuck WB6IGP.

Number 52 on your Feedback card

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Some thoughts

This month, I want to take a look at a number of different topics, so the column may seem a little disjointed ... but not rambling (I hope).

Things to do

The fall season is close upon us, so there are some things you might want to consider doing. First, if you live in the northern tier of states, you should consider winterizing the ol' antenna system before the first blasts of winter set in. There isn't a lot to do regarding winterizing, but it's time to look at the electrical connections, tighten bolts and screws, check the tuning, and inspect any insulation or weatherproofing that you use. The reason for doing these little chores is that they become big, big chores when the ice forms on the landscape! Believe me ... I know about that one!

Second, the propagation patterns in the high frequency (HF) bands change during the winter. For the most part, skip lengthens and the available DX changes. If you want to erect an antenna to take advantage of those changes, then now is the time to do it. I believe that fall and spring are the times to decide on such changes or additions because of the impending propagation changes that occur in each of the following seasons. You might, for example, want to consider a low angle of radiation antenna to take advantage of winter DX.

Third, I believe it's the responsibility of amateur radio operators to replicate themselves. That is, to become Elmers and "propagate the faith." Now that school is starting up again, you might be able to help some youngster enter the hobby. If you have a technical bent, then contact the science department of your local high school and offer to volunteer.

Two roles are likely available in most areas. First, you can be a science fair judge. Second, you can be an advisor to students and teachers on electronics- or radio-oriented projects.

In other cases, you might find other local opportunities. I exchanged E-mail (see my E-mail address above) with a ham who assisted a local high school in setting up a ham station. Another fellow helped them set up a radio astronomy receiver (which was made with a surplus TVRO satellite dish, a VHF communications receiver used as a variable IF, and a low-noise amplifier and mixer front end). Although from a technical point of view this setup was really quite simple, it also was beyond the abilities of the physics teacher and students who wanted to use it.

There are a number of different things that amateurs can help with in the area of science, especially radioscience. In my book *RadioScience Observing* (Howard W. Sams/PROMPT), which is available from Amazon Books [http://www.amazon.com], there are a huge number of ideas that can be used to help high schools and their students.

If you want to study a lot of different successful efforts, then you might want to use your World Wide Web browser and look up documents on the Search for Extraterrestrial Intelligence (SETI), radio astronomy, and related subjects. The SETI League operates a Web site on the subject. Also, if your student advisees want to do some whistler and spheric hunting (which can be done with equipment no more complicated than an audio amplifier with a front-end filter!), then check out the Project Inspire Web site (below).

Whistlers and spherics are naturally-occurring radio signals found in the 1 to 10 kHz portion of the spectrum. The receivers are basically audio amplifiers with filters that cut off frequencies below 1,000 Hz and above (usually) about 8,000 Hz. Whistler hunters generally connect a whistler receiver and WWV shortwave receiver to a stereo cassette tape recorder, and then log observations.

Bill Pine, director of Project Inspire, produced an article titled "How to Set up a Successful Listening Program in Your School." A copy can be downloaded from the NASA Web site where the Project Inspire Web page is found (see below). Bill breaks his recommendations into four phases:

1. Receiver assembly.
2. On-campus drill.
3. Evening field observations ("sunset runs").
4. Early morning observations ("dawn patrol").

Even if you are not a science teacher, you will still prove useful in the first phase: receiver assembly.

The lessons laid out by Bill Pine (material below from the NASA Web site) include:

Hour 1: Reading resistor codes, identifying capacitors, soldering technique, practice soldering on surplus components. Each student attaches at least one component to the board.

Hour 2: Attaching wires to switches, attaching wires to jacks. Each session wires one complete switch and one jack.

Hour 3: Identifying semiconductor components, attaching the IC socket to the board, pinout configurations, attaching the semiconductors to the board.

Hour 4: Attaching the switch and jack wires to the board, circuit checkout and testing.

In addition, the following activities might be areas where you can help:

1. Setting up the receivers and connecting the ground wires and cassette tape recorders.
2. Setting receiver and recorder levels.
3. WWV time marks.

Notice anything in common with amateur radio? These activities are similar to the kinds of things we do all the time in our hobby, especially if we are technically oriented!

Radioscience resources on the Web

C. Crane Company
558 - 10th Street
Fortuna CA 95540-2350
E-mail: [ccrane@aol.com]
Web: [http://ccrane.com]

Grove Enterprises
P.O. Box 98
7540 Highway 64 West
Brasstown NC 28902
Web: [http://www.grove.net]

S.P. McGreevy Productions, Inc.
P.O. Box 928
Lone Pine CA 93545-0928
E-mail: [vlfradio@triax.com]
Web: [http://www.triax.com/vlfradio/]

Project Inspire
c/o Bill Pine
Chaffey High School
1245 N. Euclid Avenue
Ontario CA 91762
E-mail: [pine@nssdca.gsfc.nasa.gov]
Web: [http://ssdoo.gsfc.nasa.gov/education/inspire/]

SETI League
Dr. Paul Shuch, N6TX, Executive Director
P.O. Box 555
Little Ferry NJ 07643
E-mail: [N6TX@setileague.org]
E-mail: [Info@setileague.org]
Web: [http://seti1.setileague.org]

National Science Teachers Association
1840 Wilson Blvd.
Arlington VA 22201-3000
Web: [http://www.nsta.org]

Will's Natural Radio
E-mail: [N4YWK@amsat.org]
Web: [http://www.altair.org]

One of the reasons for the existence of amateur radio as a hobby is that we provide some public service. Traditionally, this has meant using our ham rigs to provide communications for others, especially in time of emergency or for special events. That role seems to be diminishing as cellular telephones and personal radio service transceivers become easily available. Perhaps it's time that we look at other areas of public service to help justify our continued use of valuable segments of radio spectrum. I recommend involving ourselves in educational activities in our community.

One of the Web sites above had a neat quotation, which I paraphrase: Learning something every day is half the solution to the problem of ignorance. The other half is teaching someone something every day.

Using your rig in a hospital

Some years ago (1970s), while I was in college, I worked as a biomedical equipment technician in a medical center hospital. During that time we found a number of problems with electromagnetic interference (EMI). Medical and scientific instruments tend to be quite sensitive to EMI at close proximity to transmitters.

At that time I wrote an article on using ham gear in hospitals, and why it isn't permitted. Most people who wrote to me about the topic were surprised, but understood. A few really arrogant jerks wrote and told me they would operate their two-meter handhelds (or whatever) if they were a patient in a hospital, and no "(expletive deleted) idiot like you (meaning me) is gonna tell me otherwise!" One comment was something akin to those bumper stickers about gun control: "No one is going to take my ham rig away from me until they pry it from my cold, dead hands." Puh-leeze!

We hams are supposed to be responsible citizens. If our operation interferes with life-saving patient monitoring and related equipment, then we can do without QSOs for a short period, now, can't we? By the way, for those who don't "get it," if you feel like responding to this column like some people did to the earlier one, please spare me your ire. I won't receive it, but will reflect it back, for I have little patience with self-centered fools.

You will note that hams are not singled out. The last time I went to an emergency room (last November) was as a patient. While lying on a stretcher in an ER hallway (one tends to do that a lot in ERs), a man tried to use a cellular telephone. A security guard pointed to a sign on the wall that not only forbade the use of cell phones inside the hospital, but also required that they be turned off entirely! In other words, you cannot even have the cellular telephone in receive mode.

Why are they so sensitive to cell phones? One possible reason is that hospitals use radio telemetry for electrocardiography (ECG) in certain units. A typical ECG radio is a 1 to 10 mW VHF or UHF transmitter that picks up the ECG waveform, and then uses it to frequency modulate the transmitter. A series of antennas around the coronary care unit (or a lesser "step-down" unit) picks up the signal, and sends it to receivers at a nurses' station or special monitoring station. In some systems, the antennas directly feed a 60 dB wideband amplifier before it is sent to the receiver. Even a relatively low power signal from your ham rig or cellular telephone can drive the receiver or amplifier into nonlinearity, and produce intermodulation distortion (IMD). And that can cause problems.

I recall one problem of IMD from when I was working in the hospital. A nurse called me at 0300 or so, and told me that one patient's signal was coming in on two channels of their eight-channel system. It turned out that the problem was an FM broadcast band receiver at the nurses' station. The night nurse tuned in a station and kept it on low volume to while away the nighttime hours.

The antenna of the FM BCB receiver was located only inches from a 17-inch whip antenna protruding from the false ceiling tiles. The whip was for the ECG telemetry receivers, and was feeding a 60 dB amplifier only inches away. The local oscillator of the FM BCB receiver was radiating into the antenna and amplifier, driving it into a nonlinear operating region. Because of the specific station that the nurse was listening to, the combination of one telemetry frequency and the FM BCB LO frequency produced a second-order product that was on the operating channel of another telemetry unit. Sighhhh.

After a lot of head scratching, I located the problem on a hunch by turning off the radio. The two ECGs were in their respective channels, allowing the nurses to properly monitor both heart patients.

If you think it's difficult to get some hams to give up their rigs in a hospital, or take away the cellular telephones of visitors, try telling a night nurse to give up her FM radio! That was not an easy chore (AM BCB radios were tolerable, however). I suspect the only reason the nurses didn't disembowel me and curse my soul was that my wife was one of their colleagues (she was a coronary care unit nurse at that hospital when this occurred).

Having a bit of cardiac trouble myself, you might say this topic is near and dear to my heart (sorry, bad puns sometimes fit!).

The problem of electromagnetic interference in hospitals has gotten serious enough to attract the attention of the Food and Drug Administration. Check out their Web site for information on the problems of electromagnetic interference to medical devices. It is at URL [http://www.cdrh.fda.gov].

RF exposure and hams

There are some new regulations from the FCC regarding RF radiation exposure from our rigs. Some hams must file paperwork with the FCC. In any event, you will want to be aware of the problems so that you can guard against affecting your own health. One or more of Wayne's editorials in the past have dealt with this subject. I talked with Stu Cowan on this topic some years ago, so the issue has been around for quite a while.

If you are concerned with this potential problem, and how the problem can be cured, then I recommend that you obtain a copy of a new book published by the ARRL. It is called *RF Exposure and You* (ISDN 0-87259-662-1) by Ed Hare W1RFI. The price is $15, which is certainly cheap for a book of that size (especially one that contains information that may help you retain your health). It is available from ham radio stores, or direct from the ARRL at [http://www.arrl.org]. I also found it listed by Amazon Books, so check out [http://www.amazon.com].

Number 54 on your Feedback card

Ham to Ham

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. Last month, we went over the need for adequate lightning protection on utility lines entering our homes and ham shacks. Now picture this ...

Lightning protection—what your mother never told you, part 8

As the ground system rises in voltage from a lightning strike, the protectors will take the ground system energy and place it on the power, telephone, and cable lines, while keeping the voltages between earth and the active lines within the limits of equipment survival. As mentioned previously, the utility ground rod for the house should be interconnected to the husky radial ground system described in previous columns. If this is not the case, the energy from the tower strike will traverse the house safety ground wires to this rod, causing problems throughout the system. Interconnecting them in the ground (using bare copper strap conductors) will reduce the inductance of the interconnecting path. House wires are a parallel path. If the interconnect path is better (lower inductance and resistance), the majority of the current will bypass the house wiring. An alternative is to provide a copper strap path through the house (difficult to fly past the XYL!). But this may not be a sufficiently low inductance path anyway (due to the length needed), and it will likely radiate to other wires and equipment inside the house, to boot.

The power and telephone feeds to a house can be either aerial or underground. Most hams believe that an underground connection is superior, because it provides better protection from a potential lightning strike. Although a feed buried underground will not sustain a direct hit, the amount of energy generated if a nearby tree is struck, coupled through the conductive ground medium, can be equal to a direct hit! By being underground, the wires can actually be at greater risk. The depth at which the wires are buried is also immaterial, when compared to the depth to which low-frequency strike energy can penetrate.

Just a word for those who feel that they are safe from lightning because they always disconnect the coax from their equipment when it's not in use. When asked what they do with the disconnected line(s), they'll usually respond that they're simply placed on the floor. Stop and think about the last few thousand feet that the lightning has just jumped ... you can see the fallacy in this reasoning. In fact, they may make the situation worse, since arcing also involves ignition-temperature plasmas inside your house. While it's true that the radio may make it through the initial lightning strike, will it survive the ensuing fire inside your home? Tossing the coax out the window isn't without its problems too, especially if the coax has already entered the house from the antenna and then loops back out the window, or if the antenna is roof-mounted, and without an adequate low-inductance ground path of its own.

Grounded coax switches won't last long with direct hits either—unless other low-inductance earth-to-ground paths are provided. Remember that grounding the center conductor of the coax, and not disconnecting its shield, can still allow large amounts of strike energy to be shared with your equipment. The coax shield connects to your equipment's chassis, and if a single-point ground is not present (along with power and telephone protectors), equipment will be damaged. Here's the point: When dealing with the amounts of energy present in a lightning bolt, thinking in terms of voltage and current levels that are normally present isn't sufficient. We have to set our thinking toward very, very large amounts of energy ... energy that's looking for a way to earth-ground. Our only effective protection is to provide that path, with as few obstructions as possible. That's been the thrust of the series. Try *not* to think in terms of compromise.

Ground system materials

Solid copper (wire or strap) or copperclad steel (rod) makes copper the most commonly used earthing material. A below-grade ground system should be made utilizing the same base material. Mixing materials, like galvanized rods with bare copper radials, will create a battery action in which the zinc of the galvanized rods will dissolve into the soil. This will cause bare steel to rust, which will not provide an optimum connection to the earth. Using stainless rods to prevent corrosion will not produce the best conductivity; since stainless steel wire would be required to interconnect the rods (remember, we don't want to mix metals), the overall resistance of the system would be increased. An all-aluminum ground system should only be considered in very acidic soil conditions, and even then, the soil should be chemically tested for other aluminum-attacking soil compounds. Joints between copper radials and copperclad rods should be made by exothermic welds (see below) or by using appropriate joint compounds in high-compression clamps. Soldered connections, such as torched silver solder, will not last as long as an exothermic weld.

An exothermic weld is created with a graphite mold (for the desired connection) into which copper oxide and aluminum powders are placed. An additional starter powder ignites the exothermic process. The resultant molten copper is deposited into the lower mold cavity where it burns away any oxides and creates a larger fused connection. This larger cross-sectional bond decreases resistance and increases the surface area, which reduces the inductance of the joint. Since the materials are similar, the connection lasts as long as the remaining grounding material.

High-pressure clamps can produce a good bond between copper and copper because the material is malleable (soft and workable). However, average ground rods are only copperclad, with the majority of the rod being plain steel. The differences in the coefficient of expansion and contraction (with temperature changes) of the two materials will loosen a mechanical connection over time. The use of joint compounds helps, and further enhances the weather-tightness of the bond. The requisite high pressure must come from a material stronger than copper.

Strata problems

Rock layering within the subsoil can make ground rod insertion extremely difficult. If layering makes it impossible to continue the insertion of a ground rod, simply cut off the rod and connect it into the system as is (even one short rod is better than none). A rock layer

will hold water and salts, which means the conductivity will be good. Making more connections to areas of higher conductivity will reduce the overall impedance of the ground system.

A ground system has a finite resistance and an inductance value. The amount and location of the inductance can reduce the overall effectiveness of radials. When a radial is placed in a poorly conductive soil, the radial inductance is quite high. Conversely, when the radial runs in highly conductive moist soil, the inductance of the wire is mostly shunted by the soil's conductivity. Because copper strap has lower inductance than wire, it's been recommended throughout this series for all radial runs. The strap's extra surface area reduces inductance and the sharp edges allow for a high E-field concentration (which in turn allows arcing to occur in poor or no soil conditions). We don't really care how the charge spreads out and away from our equipment, as long as it does just that!

That's Roger and Ron's presentation for this month. If you'd like to see the original, unabridged version of this series, you can contact PolyPhaser Corporation, Customer Service Department, 2225 Park Place, P.O. Box 9000, Minden NV 89423-9000 and ask for their Special Bulletin, Protection to Keep You Communicating (©1995). You can also pay a visit to PolyPhaser's home page on the World Wide Web at: [http://www.polyphaser.com/]. PolyPhaser's Web site also supports text downloads of the original material that's going to be condensed here, plus other related texts on the subject. The PolyPhaser Tech Line telephone BBS at (702) 782-6728 is also available to interested readers. The communications parameters are: Data bits—8, Parity—None, Stop bits—1, Baud rate—300 to 14400. If you are dialing in for the first time, the Tech Line requests your name, address and telephone number. You will also need to create a password. Once you've logged on, just follow the menus to navigate around the bulletin board. The "Ham To Ham" column will continue this series on protecting your ham station from the destructive effects of a lightning strike, with part 9 coming up next month.

Switch that switch!

From Ken Guge K9KPM: "I think that we've all run into the problem of rotary switches becoming 'noisy' (i.e., making poor contact) when left in one single position over a period of time. It's never been completely clear to me why this happens; theoretically, it could be due to a couple of factors. In very low-current circuits, it may be due to a minuscule degree of arcing that could be occurring on a molecular level, which, with time, eventually develops into a high-resistance contact being formed. It could also be due to the contacts on the rotary switch 'taking a set' (i.e., losing some of their tension from being slightly spread apart). Whatever the actual reason, I believe that I've found a reasonable solution to the problem.

"I own an older Yaesu FT-101E ham-band transceiver that I have in my auxiliary station upstairs in my study. I use it when it's too cool in my basement to operate comfortably from my main ham station installation. After a time resting in one position, however, the bandswitch on my FT-101E would sometimes not make good contact when I first turned the radio on to operate. Exercising the switch (running it back and forth a few times) would usually cure the problem, but taking off the transceiver's bottom cover and spraying the switch sections with contact cleaner seemed to be a more reliable fix ... until now. Lately, I've simply been placing the FT-101E's bandswitch in the 11-meter position (since I don't operate on that band position) when I'm done using the transceiver, and then switching it back to the desired ham band when operation next takes place, some time later. Since taking up this routine, I've not had to further exercise or spray the bandswitch once, leading me to consider this practice a more or less permanent solution. Whether it's simply the self-cleaning action of rotating the switch at the beginning and end of an operating period, or the fact that tension on the switch's contacts is released during periods of non-operation is probably immaterial; and more just a matter of curiosity. That this solution works for me is the important point, and so far it's been working like a charm. Now I just have to remember to do it!"

Moderator's note: Thanks, Ken. Potentiometers (controls) and antenna switches that are rarely (if ever) changed may also benefit from Ken's suggestion. Why not give it a try?

Two for one

From Stephen Reynolds NØPOU: "In case you haven't seen them, there's a new type of bass woofer speaker on the market now, one with completely isolated dual-voice coils. Since the lower audio frequencies (in the bass range) don't really need to be directionalized (i.e., the average person can't discern which direction bass is coming from), limited-space stereo systems can usually get by with just one bass woofer or subwoofer, located midway between the left and right higher frequency speakers. Given that, the best way to combine the bass frequencies from the two stereo channels is in a totally isolated, dual-voice coil-design single woofer (see **Fig. 1**). This keeps the higher frequencies completely separate, while combining just the bass frequencies. These bass woofers are usually intended to operate in the 40 to

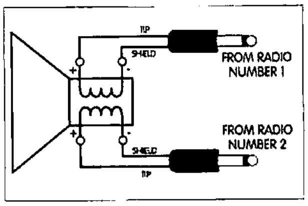


Fig. 1. NØPOU's idea for using a dual-voice coil speaker to reproduce the audio from two radios, in just one speaker, when space is at a premium.

3,000 Hz range, so they're nicely tailored for ham radio applications (a little like a built-in high-frequency noise filter!). You can find dual voice coil woofers at Radio Shack® as well as in stores that cater to the automobile sound equipment market. For the typical ham radio application, take a look at Radio Shack's six and a half-inch #40-1373, at about $25.

"Why bother with a dual-voice coil speaker in the first place? Because it allows you to feed two radios into just one speaker, with total isolation between them, yet it will reproduce both audio sources even if they're active at the same time. If you don't have a lot of extra room in your ham shack or mobile ham installation for speakers, this method may be just what you've been looking for."

Moderator's note: Great suggestion, Stephen. I can think of at least a couple places for a dual-voice coil speaker in my own installations.

Murphy's Corollary: You can't win; most times you can't even break even, but worst of all, you generally can't quit!

Thanks to those who've contributed to this month's column, especially:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

Ken Guge K9KPM
1107 E. Woodrow Avenue
Lombard IL 60148

Stephen Reynolds NØPOU
510 S. 130th Street
Omaha NE 68154

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to Moderator NZ9E at the address at the top of the column. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*. 73

Number 56 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

The European Space Agency

Since the attempted launch of the first amateur-radio, high-elliptical-orbit satellite, *Phase 3A*, in May 1980, AMSAT (the Radio Amateur Satellite Corporation) organizations around the world have relied heavily on European rockets for a ride into space. *Phase 3B*, now known as *AMSAT-OSCAR-10*, successfully reached orbit on June 16, 1983. It was launched on an *Ariane-2* rocket from Kourou in French Guiana.

Fifteen years later, *AO-10* is still in orbit and providing a communications system using its still functional Mode B transponder (70-cm uplink and two-meter downlink), when the solar panels are properly illuminated. The onboard computer failed in late 1986 due to radiation damage in the memory circuits, but the default operating mode has provided over a decade of additional use for hamsat enthusiasts. Eventually the batteries, solar panels, and radio components will fail, but in the meantime it's the only serious DX hamsat in the sky.

The European Space Agency (ESA) continues to support satellite efforts from AMSAT and educational institutions around the world. The agency has its roots in the European Launcher Development Organization (ELDO), created in 1962 by Belgium, France, Germany, Italy, the Netherlands, and the United Kingdom. That same year, the European Space Research Organization (ESRO) began operations with the five nations of the ELDO plus Denmark, Spain, Sweden, and Switzerland. Ten years later, the two groups merged to form the European Space Agency. By 1980, the agency had been joined by Austria, Ireland, Norway, and Finland. Canada is also a partner in specific ESA programs and has a seat on the ESA Council.

The primary task of the ESA is to provide a cooperative European space research program with a long-term policy to become and remain competitive in space technology. Since the first launch of an *Ariane* rocket in December 1979, they have successfully adhered to their goals.

Arianespace

The programs of the ESA require launchers to get payloads to orbit. Since the beginning, Arianespace has provided the necessary hardware and services to do the job. Arianespace is a privately-held commercial company. It was created in 1980 to do three main duties: Arianespace markets satellite launch services, is the prime contractor for the industrial production and financing of *Ariane* rockets, and conducts launch operations from the *Ariane* launch site in Kourou, French Guiana. The primary shareholder is France, with over 55 percent. Germany is a distant second at 19 percent, while the other participating countries split the rest.

Arianespace is the first commercial space transportation company with more than 50% of the market. They have launched over 137 satellites since their inception. In the past nine years, they have sent more than two-thirds of the western

world's telecommunications satellites into orbit.

The *Ariane 5* and *Phase 3D*

Most hams who have been following the *Phase 3D* project know that amateur radio's most ambitious satellite is designed to be launched into orbit by the latest *Ariane* rocket, the *Ariane 5*. Delays and launcher problems have kept *Phase 3D* on the ground, but it is hoped that agreements will be reached and problems resolved, so that AMSAT's newest satellite will get a ride to space on an *Ariane 5*.

In January 1985, the members of the ESA and *Ariane* met in Rome to begin the *Ariane 5* project. The new launcher was to be a rocket for the future, capable of taking 15,000 pounds of payload to geostationary transfer orbit (GTO), or 44,000 pounds to low earth orbit (LEO). The *Ariane 4* could only take 10,000 pounds to GTO. The new *Ariane 5* was also to be capable of taking human passengers to orbit via the *Hermes* capsule, and to transport space station modules into space for the *Columbus* program. While the space station plans and manned space activities are currently on the shelf, the work continues to make the *Ariane 5* the new heavy lifter of Arianespace.

June 5, 1996, marked the maiden flight of the *Ariane 5*. Mission 501 was unfortunately a very short ride. Software errors in the main stage control systems caused the rocket to veer off course, tear apart and explode. Debris, rocket fragments, and fuel rained down upon the French Guiana jungle. Fortunately, *Phase 3D* was not onboard, but the inevitable delays before a second attempt could be made were long and tedious.

Sixteen months after the disastrous flight of *Ariane 501*, the second mission (502) successfully took off from the jungles of South America. The flight was not perfect, but it was very close. The payloads *MaqSat H* and *TeamSat* both achieved orbit. The problems of flight 501 were resolved, but AMSAT's *Phase 3D* was not onboard.

Following the 501 mission, it was discovered that the vibration stresses imposed on payloads by the *Ariane 5* launcher were greater than expected. AMSAT was notified of the new vibration specifications after a study of the 501 launch was released by the ESA. In order to survive on an *Ariane 5*, the *Phase 3D* spacecraft needed significant structural work. If *Phase 3D* were a car, this would mean stripping the vehicle to the frame, and then designing, fabricating and installing panels and support pieces wherever stress problems might occur. It was hoped that the modifications could be performed in time for mission 502, but it was not to be. If the mechanical modifications had not been required, *Phase 3D* might have been ready in time, but the combination of new mechanical changes and ongoing payload design and integration was too much.

Phase 3D is now ready for launch, but does it have a ride? AMSAT Germany's President Karl Meinzer DJ5ZC is constantly in negotiations with the ESA working to get *Phase 3D* into orbit. While *Phase 3D* could not be easily sent to space on launchers from other countries, it can be retrofitted for a flight on an *Ariane 4* vehicle. Time will tell, and the work goes on. *Phase 3D* is loaded with all the experiments and communications transponders that it can hold. The systems have been tested, and they work.

To find out more about the *Phase 3D* program, you can start on the Internet with AMSAT's home page at the Universal Resource Locator (URL) [http://www.amsat.org]. Be prepared for quite a ride through cyberspace. Many fascinating links are available to other AMSAT groups around the world and educational institutions working on small satellites carrying amateur-radio payloads. Membership in AMSAT is open to all individuals, not just hams. A one-year membership includes six issues of *The AMSAT Journal*. Each issue includes numerous articles about amateur satellite operations, construction articles, and news about current and future spacecraft. Call AMSAT at (301) 589-6062 for more details.

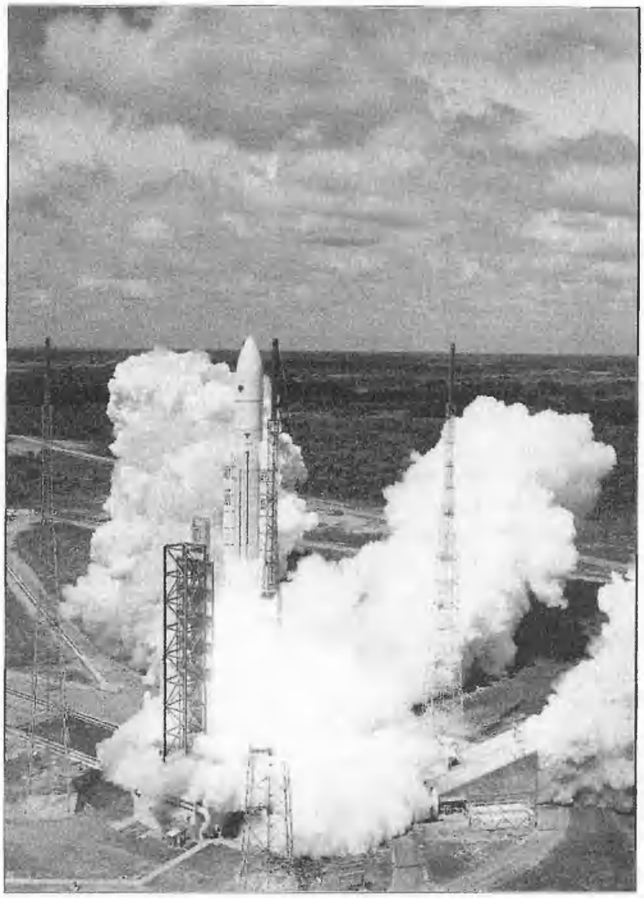


***Photo A.** The first successful flight of an* Ariane 5 *launcher took place on October 30, 1997, in Kourou, French Guiana. Photo courtesy of Arianespace.*

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

Tracking owls, cranes, and foxes

We've all seen nature shows on TV that feature biologists locating radio-tagged critters with portable direction finding gear. Migrating birds are among the most difficult to study because they travel long distances in short periods, even in weather that is bad enough to prevent researchers from following them by aircraft. Researchers are beginning to discover that the hundreds of thousands of amateur radio enthusiasts on our continent can aid their efforts. For instance, *Amateur Radio Newsline* reported that the Wildlife Conservation Corps recently sought volunteers to help study the movements of endangered whooping cranes.

Another important species being studied is the burrowing owl. In winter months, these unusual creatures can be found in the southern US, from California's Imperial Valley to Texas. They also make homes in Florida from Orlando to the keys. However, their habitat is diminishing. As a result, they are considered endangered in some places and "of special concern" in others.

Photo A. Burrowing owls blend in well with their surroundings. I discovered this one standing guard along the banks of an irrigation canal near El Centro, California.

Unlike other owls, it's unusual to see a burrowing owl in a tree. They prefer to roost in cavities on the ground in treeless grasslands (**Photo A**). By day, they stand at a burrow entrance, ready to duck inside when necessary to avoid predators such as hawks. At night, they take flight to feed on small snakes, lizards, and rodents. They fly in an undulating pattern and sometimes hover in the air to catch grasshoppers, beetles and other insects.

"Homing In" readers help

Early in March, E-mail arrived from Helen Trefry, a wildlife technician with the Canadian Wildlife Service, who is working on a project about burrowing owls. "We know so little about their movement," she wrote. "We have no idea how long they take to migrate or if they make long stops along the way. It may be that weather is a large factor in determining the rate of movement."

Owls banded during the summer in Saskatchewan had previously been recovered in southeastern Colorado and the panhandle of Texas, lending support to the theory that they migrate south through the plains east of the Rockies to spend winter months in southern Texas and nearby regions of northern Mexico. To get more data, twelve Saskatchewan burrowing owls had been fitted with necklace-style VHF transmitters before their southward migration last fall.

Ms. Trefry and her associates used the tags to learn that the birds traveled from 68 to 202 miles nightly, during the hours of darkness. In the daytime, they borrowed badger burrows to use as avian motels. Bad weather grounded the researchers' small plane (but not the owls!) after a few days. The tag signals were lost in southwestern North Dakota, near Dickinson. They were not heard again until December, when one was picked up by another aircraft 56 miles southwest of San Antonio, Texas. The remains of a banded Saskatchewan owl were discovered by a southern Texas wildlife refuge manager in December.

I agreed to attempt to find some hams along the flight path to monitor for tag signals during the anticipated northward flight period. It was too late to get the announcement into *73 Magazine*, but I put out the word via *Amateur Radio Newsline*, the *ARRL Letter*, the *Homing In* Web site and Internet mailing lists for transmitter hunters. Dozens responded, representing most of the states in the expected migration path. Hundreds viewed the burrowing owl page of my site, which gave the tag frequencies and monitoring tips. I have no way of knowing how many ham-hours of monitoring were done, but I know that the response was heartwarming to me and to the researchers. Thank you all!

Somehow, the surviving owls returned to Saskatchewan in late April and early May without being detected by hams or researchers along the way. Perhaps if more advance notice had been available and more hams had been monitoring, some valuable insights about migration rates and patterns could have been obtained. Helen wants to try again during the owls' southward flights this fall, so I'm putting out the word now.

Another biologist from the ornithology laboratory at a prominent eastern university has contacted me about the possibility of ham operators and scanner enthusiasts participating as citizen volunteers in his institution's long-term wildlife research projects. The studies could take place anywhere in North America, so we're starting the project by asking all interested "Homing In" readers to contact me. I will compile a database of potential volunteers and their geographic distribution.

Professional researchers use very sensitive narrowband VHF receivers, but scanners or two-meter ham transceivers with extended receiver range are also suitable if used properly. Multimode receivers such as the Trident TR2400 and Sony ICF-PRO80 in the SSB or CW mode will copy weak pulsed signals better than FM-only sets (**Photo B**). Tag frequencies are often grouped very closely, which may be a problem with typical 5-kHz channel spacing of scanners and ham sets.

Signal pulses from tags are very short, to conserve battery life. They occur only about once per second, so you can't just use the SCAN mode in a typical scanner to search for them. You must slowly step through the frequencies with the squelch open, listening through the noise for the "blip ... blip ... blip" (momentary quieting) of the pulses.

If you have a sensitive receiver capable of tuning from 148 to 174 MHz and wish to devote some time to protecting wildlife, please send E-mail or postal mail to me. Volunteers in rural areas are particularly needed. Let me know your location, equipment and antennas for monitoring and/or direction finding. Include your phone number if you are willing to be called. If enough hams respond from appropriate locations, we'll be able to write proposals for one or more formal research projects within a few months.

Frequency-agile foxboxes

"Homing In" for March featured a detailed description of low-cost ammunition-can foxboxes for international-style transmitter hunts. For that project, I used surplus circuit boards from crystal-controlled VHF business-band transceivers, retuning them for the southern California coordinated transmitter hunt frequency, 146.565 MHz.

There is no coordinated transmitter hunt frequency in the Pacific Northwest at this time. That's why Dale Hunt WB6BYU of Yamhill, Oregon, needed synthesized transmitters to put in the foxes he is building for events in the Portland area, and elsewhere in Oregon and Washington. He chose a new synthesized two-meter transmitter kit from Hamtronics, Incorporated, 65 Moul Road, Hilton NY 14468-9535; (716) 392-9430.

In the past, I have built several Hamtronics kits for club repeaters and for my own use. They have always been easy to assemble and tune-up problems have been minimal. The T301-2Y follows this tradition, with a plated circuit board and components of high quality. It is rated for two to three watts continuous output from 144.0 to 154.235 MHz. Models that cover ranges up to 174.635 MHz, and 216.0 to 226.235 MHz are also available.

The circuit (**Photo C**) has two main sections: a synthesizer and a three-stage amplifier chain. The synthesizer logic includes a microcontroller and a serially programmed phase-locked loop IC. It has its own voltage regulation and draws about 30 milliamperes. On power-up, the microprocessor boots and programs the synthesizer, which takes about half a second.

For repeater use, the power-up delay is unacceptable. By breaking one trace on the circuit board, the synthesizer can be operated continuously and the output stages keyed separately. But Dale found that running the synthesizer continuously in his foxboxes was causing problems. Besides the continuous battery drain, there was enough leakage of the two-meter synthesizer output into the output coax to provide some telltale signals to nearby fox hunters, even when the output stages were keyed off. So he changed his control circuits to key the synthesizer, accepting the delay at startup.

Most fox controllers are designed to key handie-talkies or mobile transceivers with a small NPN pull-down transistor. To switch the full T301-2Y supply current, which is about a half ampere, add a PNP power transistor or MOSFET. Be sure to provide sufficient base or gate drive to minimize voltage drop across the switching device.

Separating DC input voltages for the synthesizer and output stages makes it easy to control RF output power by varying the supply voltage to one or more of the amplifiers. The simple way to do this is with an LM317 variable voltage regulator. In my tests, RF power could be smoothly adjusted from 350 milliwatts to full output.

An RCA-type receptacle is provided for RF power output. "Plugs with a long center pin can short to the case under the board," Dale reports. "Hamtronics sells RF-grade RCA plugs with a shorter center pin, which I would consider a good investment. The manual warns that operating the transmitter without a 50-ohm load can destroy the transistor, and there is no SWR protection circuitry. However, specifications for the BLX-65 final transistor state that it will survive 50:1 SWR at 2.5 watts output. At one watt output, I expect it to be very robust. At three watts output, the final and driver transistors run warm to the touch, but they are room temperature at one watt.

"Transmit frequency is set with a 10-position DIP switch, using binary encoding," WB6BYU continues. "Subtract 144 MHz from the desired frequency, round off to tens of kHz, and convert to binary. The last switch is five kHz. For example, using the southern California T-hunt frequency, 146.565 - 144 = 2.565. That is the 256 switch plus the 5-kHz switch, quite easy to remember. Flip up those four switches and you are on frequency. If you have more than one favorite frequency, you can use a multipole switch or diode matrix to select the binary codes. The manual recommends realignment when changing a few hundred kHz, but I changed the frequency from 145 to 148 MHz without any noticeable difference in output power.

"Assembly was straightforward. It took about four hours to install all parts on the board. Adjustment was fairly easy, also, requiring only a voltmeter, wattmeter and dummy load. Be sure to order the special square alignment tool for the coil slugs. On the version I purchased, there is a trimmer capacitor for exact frequency adjustment. For wide temperature ranges or high frequency accuracy, a temperature-compensated oscillator option is available for $40 more. The voltage-controlled oscillator stage is a little microphonic, so you'll hear it in the transmitted audio if it bangs around loose in the box."

I checked Dale's T301-2Y on a spectrum analyzer and was favorably impressed. At all

Photo B. *This researcher uses a Sony multimode receiver and attenuator to track pulsed signals from tags on desert tortoises in California.*

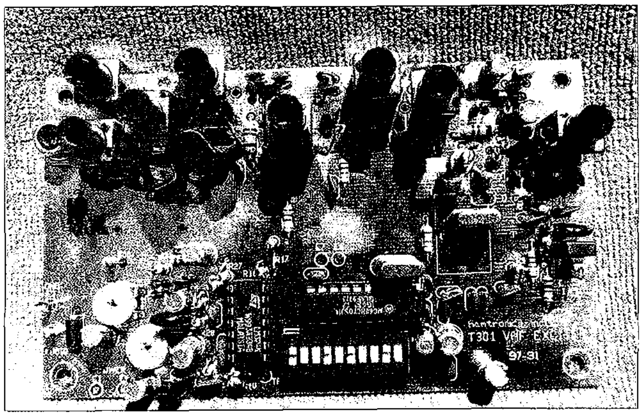


Photo C. *The Hamtronics T301 synthesized VHF transmitter board measures 3 x 5 inches.*

ON THE GO

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave., NE
Palm Bay FL 32907-1371
[ke8yn@juno.com]

In marketing, a key concept is to find a need the customer has and provide a product or service to meet that need. In many cases, however, companies reverse this concept so that they find what product or service they have and then expend all their efforts in order to convince customers that they must have that particular offering. This part of the marketing process is called promotion.

In some cases, promotion works well. In others, it may not, and companies find themselves in the "Where Are They Now?" sections of the Sunday paper. No matter how good a buggy whip you have to offer, very few will be sold.

Although amateur radio is a noncommercial service by definition, it *is* a service, and it is in our best interests to market ourselves and our service. Why should the general public allow us to have exclusive or nearly exclusive access to vast portions of the electromagnetic spectrum? Because we can meet some needs of the general public better than any other service.

People have a critical need for reliable communications, today more than any time in our history. Once we were content to receive news weeks or even months after an event occurred, but today we expect to have information current right up to the minute. Most of the time this is furnished by commercial providers, and most people assume that those services will always be available under all circumstances. Better than 99% of the time this is true, but the other 1% is when we may be called upon to provide such service.

Having a market potential of less than 1% might sound pretty small, but it is not as bleak as it might seem. There are many products or services which are rarely utilized. When was the last time you used your fire extinguisher? How about your carbon monoxide detector? Your home or life insurance policies? Nevertheless, rational people invest in each of these because they know that there is a small but very real chance that they might need one or more of these items. Our services, like these other examples, might not be used often, but they will be used. What is it that makes our services so special and sets us apart from our commercial counterparts?

1) We provide a technical service with no equipment, maintenance, or operating cost to the customer. Cellular telephone users expect to pay for their telephones and be charged for the use of the cellular telephone systems. When those systems fail, we are able to provide communications service and we do so without these costs: in fact, we are prohibited from being paid. For a ham radio operator providing emergency communications, a doughnut and a cup of coffee are the only profit he'll see.

2) We provide our services wherever they're needed. Sometimes the locations where we are needed are indeed off the beaten path. If a shelter is established at a school to provide for storm victims, or if weather spotters are needed out in the cornfield country, or a checkpoint is needed at a roadside rest miles from civilization, we'll set up and operate wherever we're needed. If necessary, we'll not only provide our communication equipment but also a generator, tent, and other facilities to support our own operations.

3) We can provide a range of services. Usually we think of heading out with a two-meter handie-talkie or mobile rig when we think of emergency communications. However, for data transfer we may choose packet. For weather spotting or search and rescue, APRS may be the preferred support. For health and welfare traffic to and from remote locations, there are the low bands and the traffic handling networks. In some cases, amateur television is gaining popularity for supporting public service efforts. We are able to select a frequency and a mode to meet most situations.

What does all this cost the general public? Very little. There is no direct cost and no additional cost recognized. All we ask is to keep the frequencies we've been able to use in the past. In today's market this means that the government as representative of the general public must forgo the opportunity to

---

levels from 350 milliwatts to full power, its harmonics and spurious emissions were better than 60 dB below the main carrier. At full power, they were -68 dBc.

In-band spectral purity of the synthesizer is also excellent. At 600 kHz away from the carrier, noise sidebands were -105 dBc in my tests, compared to values from -82 to -95 dBc on three crystal-controlled rigs that I checked at the same time. This is an important consideration if you are designing a repeater system, because high transmitter noise sidebands can cause the repetitive "kerchunk, kerchunk, kerchunk" of desense when weak signals are being received.

I belong to a club that has been fighting repeater desense problems for some time. The system has a high-power crystal-controlled transmitter/amplifier lineup and marginally-effective duplexer cavities. We temporarily replaced the two-watt exciter with Dale's T301-2Y and the desense problem disappeared! So our trustee is ordering a T301-2T (the high stability version) for a permanent replacement.

The manual is very thorough, including theory of operation, lots of troubleshooting tips, plus information about using the unit for voice, repeater and data applications. Charts of typical voltages at test points, transistors and IC terminals are also provided. "At $109, the T301-2Y is not the cheapest option for a fox transmitter," WB6BYU summarizes, "but it provides frequency agility and simple power control, and it safely provides continuous duty if needed."

Mobile sprint in San Diego

Ambitious hidden-transmitter hunts with excellent prizes are a long-time tradition at Southwestern Division conventions of the ARRL. This year's event (Hamcon-98) is no exception. T-hunt Chairman Doc O'Connor K6DOC promises a memorable San Diego-style mobile hunt. That means the first finder wins, so prepare for a rapid pace.

I anticipate multiple transmitters and short transmissions, so I suggest having lots of helpers in your vehicle—a map reader, navigator, beam-turner, and transmission-timer. This allows the driver to concentrate on efficient progress through the streets and freeways. The convention is August 14-16 at the Town and Country Hotel in San Diego, and the mobile T-hunt will be on Sunday afternoon.

Will there be other transmitters to find during Hamcon-98? Who knows? ... So better bring your sniffing gear just to be sure ... 73

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Once again, the Dayton Hamvention® has come and gone. This year the QRP gang was once again out in full force. Blessed with really fine hamfest weather all three days, the flea market was a shopper's paradise!

In the last several years, we have seen a glut of NE602-based QRP monobanders. At the hospitality suite, there were two new rigs introduced. Both were multiband transceivers, and both were multimode as well. Best of all, they both start off life as kits!

The M1 from S&S Engineering

The first one we'll look at comes from our friends at S&S Engineering. It's called the M1, a multiband, multimode (USB, LSB & CW) QRP rig. With a continuous frequency range of 1.8 to 30 MHz, the M1 also sports an honest-to-goodness AM detector. There's an adjustable audio filter with 100 Hz to 3 kHz bandwidth. You have your choice of either manual or automatic gain control.

You can cruise the ham bands with 1 Hz to 10 MHz tuning rates. You can also input an operating frequency directly from the keyboard if you desire. If you choose to transmit, the M1 will produce five watts of RF into a 50-ohm load.

Of course, you'll get all the bells and whistles you've come to expect with today's modern microprocessor. There are RIT, SPLIT and band stacking registers in the M1, and a built-in keyer with digital speed and weight settings.

Optional features you can add to the M1 are a Collins 2.5 kHz SSB filter; a backlit display with adjustable brightness and optically coupled shaft encoder; and a digital power and VSWR meter may be added as well.

Looking into the prototype Dick had on display, the M1 looks like a simple kit to assemble, thanks largely to the microprocessor. There are a lot of surface-mounted components inside the M1. Several of the larger surface-mounted ICs will come presoldered to the PC board. The M1 is seven inches by nine inches by two and a half inches.

It has a lot of options. You can more or less custom-build your own by adding on the options you need at the time of assembly.

The price of the M1 has not yet been carved in stone. According to Dick, the price will be between $600 and $700 for the kit. The M1 looks like a winner—and if it works as well as the other products from S&S Engineering, they *will* have a winner!

The Elecraft K2 transceiver

A new company to appear in the QRP marketplace is Elecraft. They introduced the new K2 all-band SSB/CW transceiver kit. The K2 covers 160 through 10 meters. As it comes, the K2 will operate CW. You can add on the SSB module, 160 meters and a high-power PA. The K2, with the high-power module, will kick out 50 watts of RF. Although far from the QRP power levels most of us use, this opens up an entirely different market for the K2. A 100-watt internal PA is also under consideration.

The K2 is just under three inches high by nearly eight inches wide and a little more than eight inches deep. It weighs about three pounds without any of the internal options added. Out of the box, it covers 80 through 10 meters (160-meter band is an option). A built-in keyer is also standard.

You get two VFOs for split operation. RIT and XIT are standard, too, as are direct keypad entry of frequencies and memory channels, memory channels store mode, VFO A/B, split, and RX filter and RX sideband. The main tuning knob has three turning rates: 1, 10 and 100 kHz per knob revolution. You get 10 Hz tuning resolution.

The K2 has some interesting features. I really like the low power demand of the receiver. It requires only 100–150 mA of current in the battery save mode. This makes it possible for long-term operation with just a small battery back.

Inside the K2 that was on display at the Hamvention, I noticed the lack of internal wiring. There was some, but most of the interconnections between the main board and the display

---

sell our frequencies to commercial interests. With everything so fiscally driven in this day and age, it is very tempting for our officials to want to sell off this seemingly little-used resource and apply the revenues to other purposes. However, if we continue to have access to these frequencies, we'll continue to provide our service. Even though *we* know we're an answer to the public's needs, how do we make sure that the *public* knows and has confidence in us?

First, we need to make certain that we deliver what we promise. If we have an obligation to provide a service to the community, we need to be physically, mentally, and technically prepared. Do you keep a radio handy at all times? Is your "grab bag" ready to go if you are called upon to serve? There's nothing more pathetic than a ham reporting to a remote site with only a handie-talkie, a rubber duck, and a single battery pack. Do our customers, whether the city or county, the Red Cross or the Salvation Army, know how to get the area hams mobilized? Can we provide services for an extended period? How about reciprocal support agreements with nearby communities? Murphy's Law tells us that we will be needed at the most inopportune time and under the worst conditions possible.

Second, we need to ensure that our efforts are recognized. Do the local weather reporters acknowledge SkyWarn's contribution when reporting on bad weather? How about a banner that reads "Communications Provided by Amateur Radio" to display whenever we set up a public service station? Have you invited members of the city council to Field Day? If you have trouble getting noticed by the local evening television news, how about a neighborhood newspaper or even a neighborhood association newsletter? Depending upon your timing, it may be easier to get publicity than you think. As this column is being written, the headlines have mainly focused on the last episode of "Seinfeld," the delay of release of Windows 98™, the death of Frank Sinatra, and the hype surrounding the new "Godzilla" movie. I hope these are indications of slow news days, rather than a reflection of what has become of key importance to us.

How has your club sought out recognition? What special projects is it undertaking? Send me a quick note and I'll include the best ideas here. The E-mail and snail-mail addresses are at the top of the column. Who knows? You may be able to get better local publicity if you include a copy of an article or column from this magazine!

board are made by plug-in connections. This wireless design will certainly ease construction of the K2. Oh yes. I almost forgot—the K2 is a kit!

As far as I could tell, there are no surface-mounted components used in the K2. I do know you have to wind the various toroids inside the rig. However, in talking with the people from Elecraft, they may offer an option of having all the coils prewound. That will be an extra-cost option, however.

Another slick design feature of the K2 is the use of built-in test gear. The K2 includes a voltmeter, frequency counter, RF power meter and microprocessor-based self-alignment firmware to speed the alignment of your K2. You don't need a bench full of expensive test gear to get the K2 up to perfect specs!

There's a boatload of options for the K2. Among them are the SSB option, 160 meters, and a noise blanker with variable threshold and buffered IF output to the rear panel. You can also get an automatic internal antenna tuner and an internal gel-cell battery.

As I mentioned earlier, you can add on a 50-watt PA, and if you're into computer-controlled rigs, you can add the host computer remote control via RS232.

Also available are the SWR/power and A/B antenna switch. There are additional RX crystals filters and a low-noise analog audio CW filter with multiple bandwidths. Whoa! The K2 sounds like a QRP operator's dream rig!

Price is set at $549 for the basic unit. Add $79 for the SSB option. The 160-meter option is $29, and it's $29 for the noise blanker.

Factory-assembled QRP transceivers were also introduced. There were two units on display at Hara Arena. They both were working prototypes, with stock available later this year.

The SGC-2020

Without a doubt, the SGC-2020 drew the largest crowds this year. They were really promoting their new QRP rig—although it's a bit of a stretch to call it a QRP rig. The 2020 produces up to 20 watts of RF. You can set the output power from zip to 20 watts, with five watts the best for long battery life (using the PortaPak™ pack).

Covering all modes, the 2020 also covers all the ham bands. Modes of operation are SSB and CW. You can receive AM, but the 2020 does not support an AM detector.

The 2020 has a backlighted LCD display that provides most if not all of the operating specs. You can turn the backlight off to conserve power. The 2020 also includes a built-in keyer for CW. You can also operate many of the digital modes, as the 2020 switchover time is about 10 ms.

The 2020 is two and three-quarters inches high by six inches wide by seven and one-quarter inches long. It weighs two and a half pounds and has a list price of $625.

The 2020 also has the full support of a microprocessor deep down inside its slim case. You get all the bells and whistles we have come to expect. You get a slew of memories, split operation and RIT/XIT.

The PortaPak for the SGC-2020

The SG-2020 PortaPak is a portable carrying case and power system. Inside, there is room for a CW key and other accessories. The overall size of the PortaPak system is about three by sixteen and a half inches. The PortaPak has an adjustable nylon strap, and can be easily carried over the shoulder or in the hand. The full PortaPak system is a sturdy, compact package, well protected for all climatic conditions—but a cautionary word: The present portable package is *not* waterproof.

Professional high-quality stainless steel latches provide reliable, secure connection of the battery pack and front panel cover. The cover provides protection for the front of the radio and storage for the microphone. Ten D-cell flashlight batteries will operate the unit for several days, depending on usage and power output. Special D-cell batteries can be purchased and will provide up to 12 Ah operation; D-cell NiCd batteries can be used and will provide up to 4 Ah operation. The battery container is designed for 10 batteries and will provide 15.5 volts for D-cell alkaline, or 12.4 volts for NiCd batteries.

The Patcomm PC-9000 QRP HF transceiver

The PC-9000 is a compact HF transceiver that covers all nine HF amateur bands. SSB and CW modes are standard and there is the option to add the same built-in RTTY and Morse decode capability that has made its big brother, the PC-16000, outstanding. Six meters is included, and an FM module is also available separately. The unit's compact size (eight inches wide by two and three-quarters inches high by seven and a half inches deep), standard noise blanker, and 12 VDC power requirement make the PC-9000 the ideal rig for mobile or portable use. The built-in keyer and keyboard interface make it a joy for the CW enthusiast. Dual output levels (5 W and 40 W) and an amplifier control jack allow operation from QRP to QRO. The receiver is a single-conversion design using dual DDS synthesizers for improved phase noise (no PLLs are used). Excellent selectivity is achieved with a 2.4 kHz bandwidth crystal filter in the (10.7 MHz) IF stage. Additional filtering is obtained with a continuously variable SCAF filter (400 Hz to 2500 Hz) in the audio stage. Three tuning rates are provided: 1 kHz for CW or fine-tuning, 12 kHz for SSB, 120 kHz per knob revolution for quick scans across the band. A lock button to disable the tuning knob is also provided to prevent unintended frequency excursions during mobile/rough operation. RIT and SPLIT operating modes are supported, and SLOW/FAST AGC selection is provided. The standard configuration of the PC-9000 includes a connector for an external IBM-type keyboard and software for sending CW. The optional RTTY/Memory upgrade software/hardware package will add Morse and RTTY decode (and RTTY send) functions, as well as Direct Frequency Entry (from the external keyboard) and memory storage.

The PC-9000 has a list price of $799. Street price will be lower, but I don't know by how much. I have a feeling you're looking at around $600 for a basic PC-9000.

All of the new rigs I've talked about this month are kind of expensive. However, you must take into account the fact that they all are multiband and sport both SSB and CW. Several even allow you to receive AM for some shortwave listening if you desire. All in all, I think the QRP family will really latch onto the new rigs.

Whether you like to roll your own, or just want to open up a box and play, there's really a selection out there this year.

I especially like the ability to add the internal/external battery packs. It's now possible to operate all-mode multiband QRP just about anyplace on the planet.

Sources

S&S Engineering
14102 Brown Road
Smithsburg MD 21783
(301) 416-0661
[n3sad@aol.com]
[www.xmetric.com/sseng]

Elecraft
P.O. Box 69
Aptos CA 95001
(408) 662-8345
[radio@elecraft.com]
[www.elecraft.com]

Any SGC dealer or
[www.sgcworld.com]

Patcomm
7 Flowerfield M100
St. James NY 11780
(516) 862-6511

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

It's summertime, and hot here in the mid-Atlantic. Let's just stay inside in the air-conditioning and answer some of your questions.

Bill Karl W2BY passes along the following:

"I am new to RTTY. I am using Hamcomm 3.1, a TS-440s and an SB 200 linear. I run at about 200 watts out to a TA 33jr and this is satisfactory. I like to run the TS-440s at no more than 30 watts output to conserve the finals, though I've been told that I can run as much as 50 watts out without damage. I was intrigued by your recent column on QRP RTTY. I have been wondering what kind of power levels are typical for RTTY operation. I assumed that almost all operators used an amplifier, especially with band conditions as they are now, but apparently some hams operate RTTY barefoot. Prior to joining the RTTY gang I was operating PACTOR. Since this is a bursty mode, I could safely run the TS-440s at full output. I would be interested in your comments."

You are correct, Bill, that band conditions play a large role in power requirements, but a lot of RTTY operators use a lot less power than you might think. With the semi-redundant nature of an FSK signal, a good demodulator can often pull a signal out of static that practically obscures it to the ear. So, I say, go for it! Will you work everyone on the air? Of course not. But you can certainly have a great time, and make any number of RTTY contacts, without blowing your finals or your wallet on an amplifier. Keep in touch and let us know how you do.

Rudy Ault N2JZK writes:

"I have been reading your column in *73* off and on for some time now, and I've decided to get back into the RTTY mode.

"Before the dawn of time, there was a program which would convert the Radio Shack Tandy Color Computer II into a RTTY transceiver. I used one for a long time, with wonderful results. Do you have any idea where I could obtain this program these days?"

Years ago, Rudy, this program was available, I know, on the Delphi on-line service. Now, I have not been on Delphi in quite some time, and I am not even sure whether or not the service still exists. I did a search of several databases and was unable to find a current listing for the programs. Unfortunately, my CoCo system bit the dust a few years ago. If anyone has a system on line, and can send me a copy of the program by E-mail, I will post it on the "RTTY Loop" Home Page for downloading.

Terry Burkholder NP3G is "in search of ..." and I think we have the answer. He writes:

"I am looking for a list of frequencies for commercial RTTY news and weather info that we can copy from the Caribbean. Trying to get set up for the hurricane season, so that if we lose the Internet will have somewhere to go to get weather info."

The solution comes from our friend overseas, Joerg Klingenfuss, who puts out an extensive line of books and CDs with frequency information.

This summer, they announce the publication of four new products:

- *Radio Data Code Manual*
- Set 2, Compact Disc Recordings of Modulation Types
- *1998/1999 Guide to Worldwide Weather Services*
- *Shortwave Communication Receivers 1942–1997*

The new *Radio Data Code Manual* has been expanded to nearly 800 pages, and now includes more than 230 graphics and screen shots, plus the revolutionary Unicode tables for all major scripts and languages worldwide. New aeronautical telecommunications technology such as ACARS, ATN, CIDIN, CNS, and INMARSAT and recent amendments to certain meteorological code forms are covered, as well as thousands of new meteorological station index numbers, aeronautical location indicators, and aircraft and airline designators.

Set 2 of the Compact Disc Recordings of Modulation Types covers more than 120 new recordings on two CDs: ACARS, ADPCM, ALF, ALFA, ALIS-2, ARS-Guard, ASCII Slovak, ATC-RADAR, ATIS, AWACS-NATO, BR-6028, BUL-ASCII, CALLSEL, CIS (various), Clover, Clover-2000, Coquelet-13, Coquelet-80, CVSD, DATATRAK, DECCA, DECTRA, DGPS, Dialup (V22, V22bis, V32) and Leased Line standards (V21, V23, V26, V26bis, V27bis, V27ter, V29, V33), DME/ILS/VOR, DTMF, DUP-FEC-2, EFR, ERMES, Eurosignal, FAF-FAX, FEBECO, FMS-BOS, G-TOR, GAF-FEC, GN-FEC, HARP, HARRIS RF-5710, HELL, HYPERFIX, JOINT-STARS, LORAN-C, Manchester, Micro-PCM, MPTI 1327/1343, NDB, NMT900, Packet Radio, PACTOR, PACTOR-2, Pager, PSK31, RELP, RIPLE-Control, SELCAL (various), SSTV (all modes), TMS-430, TT2300, Vocoder, and much more.

The new *1998/1999 Guide to Worldwide Weather Services*, just the answer to Terry's question, covers the latest Internet, Navtex, radiofax and radiotelex meteorological data sources worldwide. It includes hundreds of sample charts, home pages, images, and messages recently monitored.

For customers outside of North America, they now offer Fred Osterman's brand new third edition of his bestseller *Shortwave Communication Receivers 1942–1997*. It now covers no fewer than 770 communication receivers, with dramatically improved coverage of Australian and European manufacturers.

For detailed descriptions and sample pages and color screen shots, surf to their Web site at [http://ourworld.compuserve.com/homepages/Klingenfuss/].

From books to software, the questions keep coming in. Amrum KB9DD says:

"I was active on RTTY many years ago (pre-computer days) and now want to get active again. I have both Mac PPC and PC (Intel 200MMX) platforms. Can you suggest what you think would be the best software (either commercial or shareware) to use? I would prefer split screen to basic comm programs like Zterm."

Thanks for the chance to plug my site, Amrum. The "RTTY Loop" Home Page has an extensive listing of software available, for a nominal cost, that is sure to fill your needs. Just check it out at [http://www2.ari.net/ajr/rtty/] and scan the list of programs available from the Software Collection. Readers not on line may obtain a copy of the list by sending a self-addressed, stamped envelope with a request for the Software Collection directory to the address at the top of this column.

This is not the only place to have your RTTY questions answered. Mark Gustoff WO7T asks:

"Are you aware of any user groups I can post a RTTY question to? I'm struggling with hookup of my FT-920 to my PK232MBX. I suspect most of

Continued on page 74

Ham Radio Fun

Determining Antenna Feedpoint Impedance

Even you *can learn from this tutorial.*

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

How do you find the feedpoint impedance of a resonant antenna? Have you ever attempted to match a transmission line to an antenna? What method did you use for determining when the feedline impedance was matched?

Of course, measuring the feedpoint impedance and measuring the resulting VSWR will lead you toward a proper match. But what do you use when an impedance bridge and a VSWR indicator are not available? Certainly, you can guess and/or make a judgment.

A method is described here for determining the mechanical dimension that relates to an approximate impedance value and provides a judgment guide to impedance matching. Once the transmission line is attached, it is only necessary to fine-tune the adjustment to achieve a proper match.

Before continuing with determining the antenna impedance value, a short review of transmission lines must occur. Everyone is familiar with coaxial cable and TV twinlead. Both are transmission lines suitable for use in communication systems. But what do you know about these two types of transmission lines? Perhaps the first important fact is that twinlead is a balanced line and coax is unbalanced. What is the difference between balanced and unbalanced? The two words themselves describe the differences.

Let's consider the twinlead first. It is two identical wires running parallel. Being balanced, the two wires exhibit the same characteristics. The easiest way to understand the balanced concept is to consider yourself as being a bird and to sit on one of the wires while looking at the other. Then hop over to the other wire and look back at the first one. What do you see and conclude? Of course, the two wires look exactly alike, and that means that they are balanced.

What about coax? It also has two conductors that run parallel, as does twinlead. However, when you try the bird's-eye view again, what do you see? One wire completely surrounds the other and they are not alike. Therefore, coax is an unbalanced line.

The characteristic impedance of a transmission line is usually known. Therefore, a discussion is unnecessary here as to how the impedance of a line is determined.

Transformer impedance theory

With that in mind, let's continue with finding the impedance of a resonant circuit, which may be a coil and capacitor connected in parallel, or perhaps a dipole antenna. The impedance correlation between the two is identical, and transformer theory/calculation can be used to find the impedance at various turns of the coil or at mechanical points along the dipole.

For this process to work, it is necessary to make an impedance assumption for the calculations to provide useful data. If one end of the coil is grounded, then the impedance at the ground end is considered to be zero ohms, and the top end of the coil is 1000 ohms. Where does the 1000 ohm figure come from? In free space, the impedance would be infinity, but when the circuit is loaded by the surrounding environment and a realistic circuit "Q," the impedance is lower than infinity. But how low? Some believe the

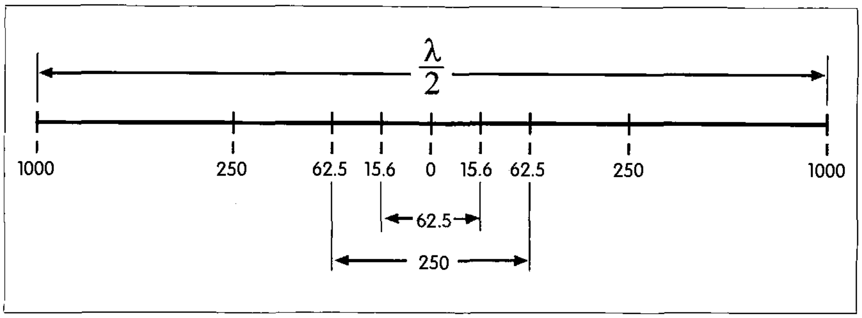


Fig 1. Impedance distribution along a solid half-wave dipole in free space, assuming the end impedance to be 1000 ohms. Balanced feedpoints shown.

top of the coil impedance is 2000 ohms; others believe it is around 1000 ohms. Take your choice of value, as the results of using the mechanical method of impedance determination will end up being reasonably close.

For the examples discussed here, 1000 ohms will be used. Following transformer impedance theory, the impedance varies as a function of the square root of the turns ratio, which means that one-fourth of the inductor's total impedance will be found at its center tap. Using this theory, let's find the impedance at the center of a coil whose impedance is zero ohms at the ground end and 1000 ohms at the top. The center tap on the coil will yield an impedance of 250 ohms, which is one-fourth of the total impedance. Now that was easy, wasn't it? Next, what is the impedance at one-quarter of the coil up from ground? Simple! If the impedance at the center point is 250 ohms, then at the one-quarter point, which is halfway between the center tap and ground, the impedance will be 250/4 = 62.5 ohms.

Finding element impedance mechanically

The impedance along the surface of a dipole antenna can be determined in exactly the same way as taps on the coil. **Fig. 1** shows impedance values at various mechanical points along a half-wave dipole whose center impedance is zero ohms, and whose impedance at each end is 1000 ohms. Half the distance between one end and the center of the dipole yields an impedance of one-fourth of the end impedance, or 250 ohms. Half of the remaining distance is one-fourth of 250 ohms, or 62.5 ohms. Again, half the distance between the 62.5 ohm point and zero is 15.6 ohms. Really simple, isn't it?

So what does all of this mean? It means that you can now predict with reasonable accuracy the impedance at various mechanical distances along the antenna element as long as the element is a solid conductor from end to end. When the center of the element is broken, the feedpoint impedance will be in the 66–72 ohm region. It will be balanced. The mechanical technique described for determining the impedance for a solid element does not apply to an element with a broken center.

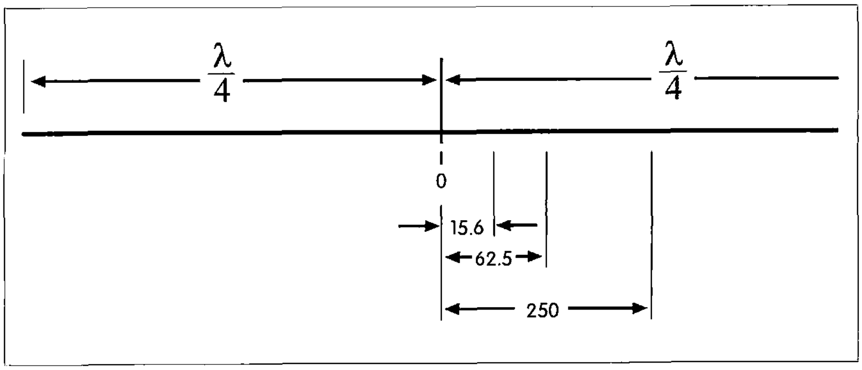


Fig. 2. Unbalanced feedpoint impedance distribution along a counterpoised quarter-wave element. Counterpoise may be a ground plane or another quarter-wave element.

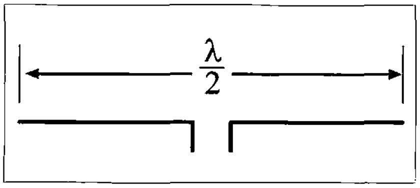


Fig. 3. Broken center half-wave dipole—feedpoint impedance is 66–72 ohms balanced.

Once the element feedpoint impedance distribution is known, it is time to select a transmission line and connect it to the antenna element. Starting with 300 ohm twinlead, as an example, where should it be connected to the half-wave dipole? Did I hear you say just beyond the two 250 ohm points? No! From zero to a distance just beyond one of the 250 ohm points? No again! Well, then, where can we connect the twinlead?

First, 300 ohm twinlead is a balanced line and must be connected at balanced feedpoints on the antenna element. Observe the mechanical length from zero to the 250 ohm point. Find the same length centered over the zero point and you will find the points to be at 62.5 ohms. Yes, we want 300 ohms; therefore, divide 300/4 = 75 ohms. Locate the 75 ohm points, one on either side of the zero, and attach the twinlead for a near-perfect match.

Coax is an unbalanced transmission line. Should we select 52 ohm coax, where would it be connected to a half-wave dipole? Using **Fig. 2**, connect the outer conductor (shield) to the zero point on the antenna, and the coax center conductor to the 52 ohm point on either side of the zero points on the element. It doesn't matter which side, as the antenna remains balanced because an unbalanced transmission line is matched to an unbalanced feedpoint on the element. Will this mechanical matching technique work with a quarter-wave dipole? Yes, as shown in **Fig. 2**, as long as the dipole is grounded at the zero point to a suitable ground plane.

One caveat to this application is that the mechanical space between the zero point and 52 ohms may exceed the dimension between the coax's shield and

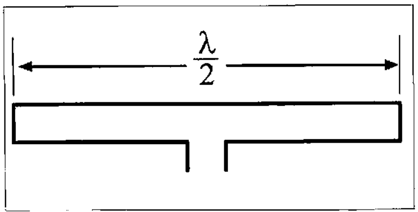


Fig. 4. Broken center folded half-wave dipole, feedpoint impedance is 300 ohms balanced.

center conductor and should not be connected directly to the element because a discontinuity would occur. To solve the problem, a gamma match is used to translate the spacing difference and still provide a proper impedance match.

Please note that many antennas currently in use have an unbalanced transmission line connected to a balanced feedpoint on an antenna. Yes, the impedance value is matched and the system may function well, but the balanced/unbalanced condition is not satisfied and a discontinuity will exist. The discontinuity results in a VSWR of about 1.5:1 which cannot be reduced simply by moving the feedpoint tap back and forth. A *balun*, which is a balanced-to-unbalanced transformer, is frequently used to solve the discontinuity problem.

As a reminder, the impedance of a dipole, whether quarter-wave or half-wave, can be determined as indicated when the antenna is operated in free space. And when enclosed in proximity with other elements as in a yagi configuration, the impedance will decrease. Yet, the approximate feedpoint impedance value can still be estimated using the mechanical technique by reducing the element end point impedance by about 10–20%.

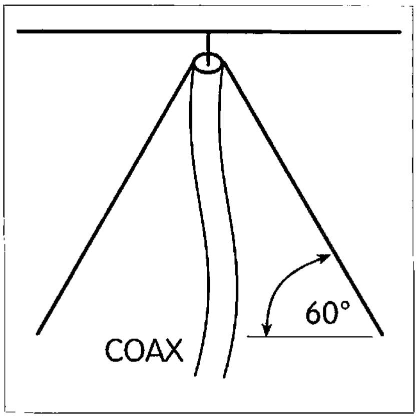


Fig. 5. Discone antenna, feedpoint is 52 ohms unbalanced.

Basic antenna impedance values

The feedpoint impedance of an antenna is determined by design and proximity to other elements. In each of the illustrations shown in **Figs. 3–10**, note the mechanical configuration of the element and whether it presents a balanced or unbalanced feedpoint to the transmission line. Some of the impedance values obtained by a design may not match the standard impedance value of transmission lines. Therefore, the closest transmission line impedance is usually selected for use and the resulting VSWR is either tolerated or some impedance adjustments are performed. When there is a known impedance difference the resulting VSWR can be estimated by dividing the higher impedance value by the lower. VSWR values below 2:1 rarely interfere with the ability to communicate via radio, but it is desirable to reduce the VSWR value as much as possible. The VSWR detector in most solid state transmitters have a threshold set for about 1.5:1, making it mandatory to have a VSWR value lower than 1.5:1.

Basic antenna types

Each of the antenna types shown in **Figs. 3–10** represents a basic antenna type with the figure providing an indication of the feedpoint impedance for each. The dipole antenna shown in **Fig. 3** is a half-wave element with a broken center. The feedpoint is balanced with an impedance in the range of 66–72 ohms, which is controlled to some degree by the element diameter-to-length ratio. Changing the center gap does not materially affect the impedance value, but a narrow gap is preferred.

Another version of a half-wave dipole is the one shown in **Fig. 4**, a folded dipole. It exhibits a balanced feedpoint impedance of 300 ohms. Folding the ends of the dipole raises the feedpoint impedance as compared with **Fig. 3**. A small change in the feedpoint impedance

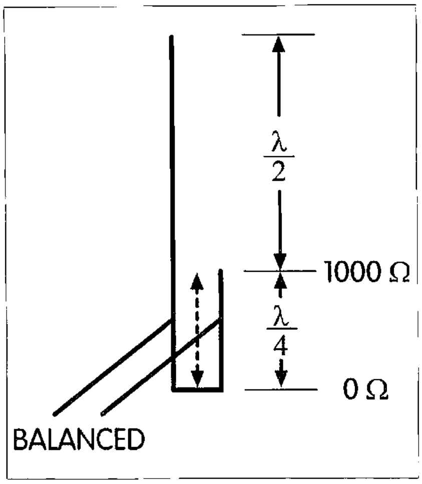


Fig. 6. "J" antenna showing a balanced feedpoint that is variable from 0–1000 ohms.

may be accomplished by changing the diameter ratio between the two parallel elements.

The antenna shown in **Fig. 5** is a discone which covers a wide frequency range while maintaining a constant unbalanced feedpoint impedance of 52 ohms. The gap between the disk and the top of the cone must be kept small.

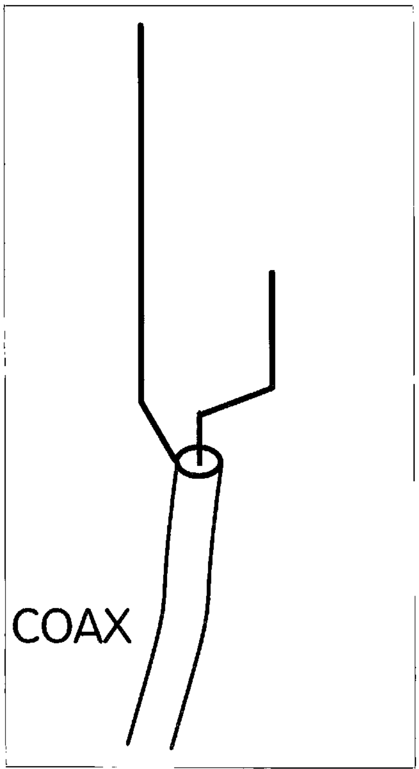


Fig. 7. "J" antenna showing an unbalanced feedpoint of 52 ohms.

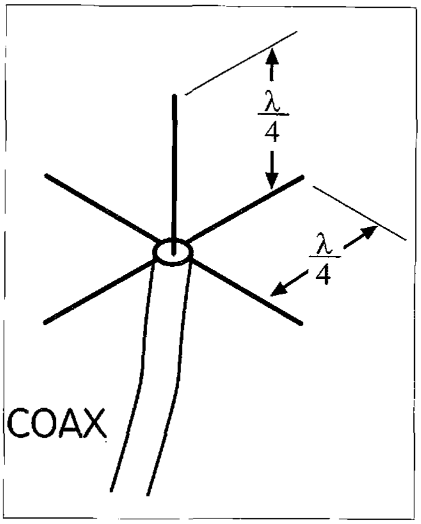


Fig. 8. Simple ground plane antenna. Feedpoint impedance is 23 ohms unbalanced.

A "J" antenna is shown in **Figs. 6** and **7**, with each having a different feedpoint. A "J" antenna utilizes a quarter-wave matching transformer mounted on one end of a one-half-wave element. The half-wave element is endfed at a high impedance from the transformer section. The transformer section operates as a resonant matching stub, permitting a balanced variable matching impedance for a transmission line from zero to approximately 1000 ohms. The impedance distribution along the transformer section may be determined by using the mechanical technique described previously. As shown in **Fig. 7**, the bottom of the transformer section has been broken, creating an unbalanced feedpoint exhibiting an impedance of 52 ohms.

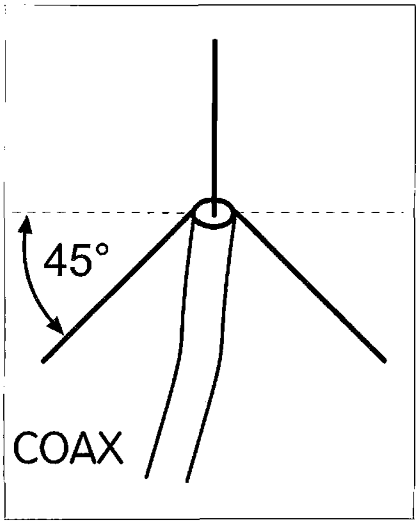


Fig. 9. Modified ground plane antenna with ground elements bent down 45 degrees below horizontal. Feedpoint impedance is 52 ohms unbalanced.

Figs. 8 and **9** show a ground plane antenna in two configurations. **Fig. 8** is the basic form in which the ground elements are 90 degrees to the antenna element. In this configuration, the feedpoint impedance is approximately 23 ohms. Because of the low value, the impedance must be raised in order to match the 52 ohm impedance of available coax. The impedance at the feedpoint may be raised as shown in **Fig. 9** by lowering the ground elements. At a down angle of approximately 45 degrees, the feedpoint impedance will be raised to 52 ohms.

The antenna shown in **Fig. 10** is a coaxial antenna and near cousin to the ground plane shown in **Fig. 9** where the ground elements are lowered to become parallel with the plane of the vertical element. Even though the elements are one-half-wave in overall length, the lower element is usually a tube that surrounds the coaxial feedline, which makes the two element sections electrically similar but mechanically different. As a result, the feedpoint becomes unbalanced and exhibits an impedance of 66–72 ohms, similar to a broken half-wave dipole.

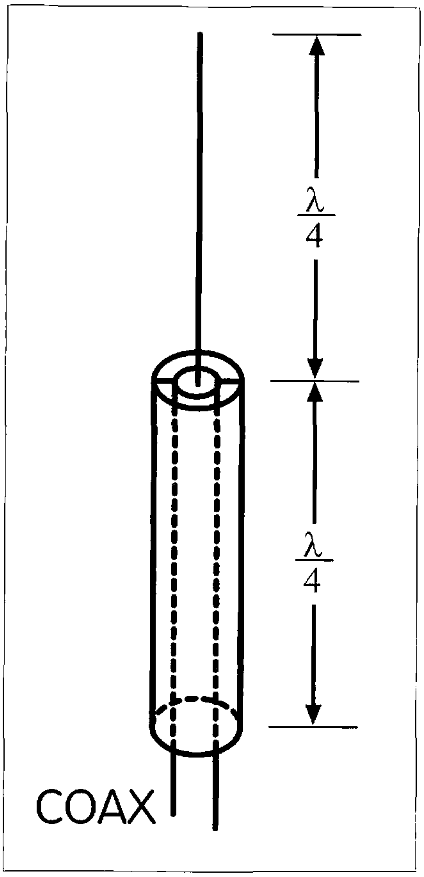


Fig. 10. Coaxial antenna. The lower quarter-wave element surrounds the feedline. The feedpoint impedance is 66–72 ohms unbalanced.

Conclusion

The impedance distribution along a resonant antenna element may be determined mechanically. The usefulness of knowing the distribution aids in the construction of the antenna and selection of a suitable feedline. The *caveat* to the mechanical-impedance determination is that the actual element impedance is directly affected by the proximity of other elements surrounding the antenna, requiring some mechanical compensation in the measurement, but understanding the approximate location of various impedance values along an antenna element helps the builder make construction decisions. 73

In Search of a Simple Capacitor Tester

A midsummer night's dream project.

Robert B Landon KD6ORG
6860 Eddinghill Drive
Rancho Palos Verdes CA 90275
[rlandon@flash.net]

If you're like me, you have accumulated in your junk box many little things that look like capacitors. If only you had the Rosetta stone, you could figure out the meanings of all the weird colored dots and microscopic printing on these junk box parts. Then, you might even be able to find a use for them someday. Alas, except for a few random successes wrought by studying numerous handbooks, for me the dots have remained just dots and the parts, unusable junk.

After becoming frustrated by having to purchase a new capacitor just to be certain of its value, I decided to find a way of measuring the existing capacitors in my junk box. A quick review of the catalogs showed that there are lots of capacitor testers on the market. Most of these are included with digital multimeters. Also quickly noted were the prices of these little jewels! I was not interested in making a career out of measuring capacitors and already had a multimeter. Also, I didn't need to measure the big capacitors where you can read the values on the body of the capacitor. Armed with these ground rules, I began my search for a simple capacitor tester (a.k.a. cheap!).

The method described in this article was selected after many false starts and failed concepts. It has proven to be quite forgiving of construction techniques, battery voltage changes, and varying voltmeter impedance. In addition to these features, it only uses one low-cost chip, so it certainly qualifies as being inexpensive.

General design concept

The basic method uses the time it takes to charge the unknown capacitor to a particular voltage. This procedure results in converting the unknown capacity value to a time value. The larger the capacitor's value, the larger the time value. This time value is then used to establish the pulsewidth of a recurring waveform and thus control the recurring waveform's average DC value. Thus the time value is converted to a voltage value, which can then be measured by any voltmeter. A highly asymmetrical multivibrator running at approximately 250 Hz controls the recurring waveform's basic time frame.

The chip used is a 339 quad comparator chip. This chip features very low current drain, input power supply levels up to +36 volts, large input current capability for quickly discharging the capacitor under test, and the ability to use "wired AND" on the output. The output circuit performs like an open collector of an NPN transistor and can be wired together so that any comparator can pull the collective output to zero. Use of this technique saved having to add a logic chip for that function.

Another very nice result of this feature is that the output can be shorted to ground without any problem. The circuit described here uses a nine-volt battery. However, the circuit has been successfully tested with supply voltages up to 18 volts. The only change caused by this 100% increase in supply voltage was to increase the full-scale output voltage. This change was easily corrected by adjustment of the scale control.

This tester can measure capacitance values from the picofarad range to the

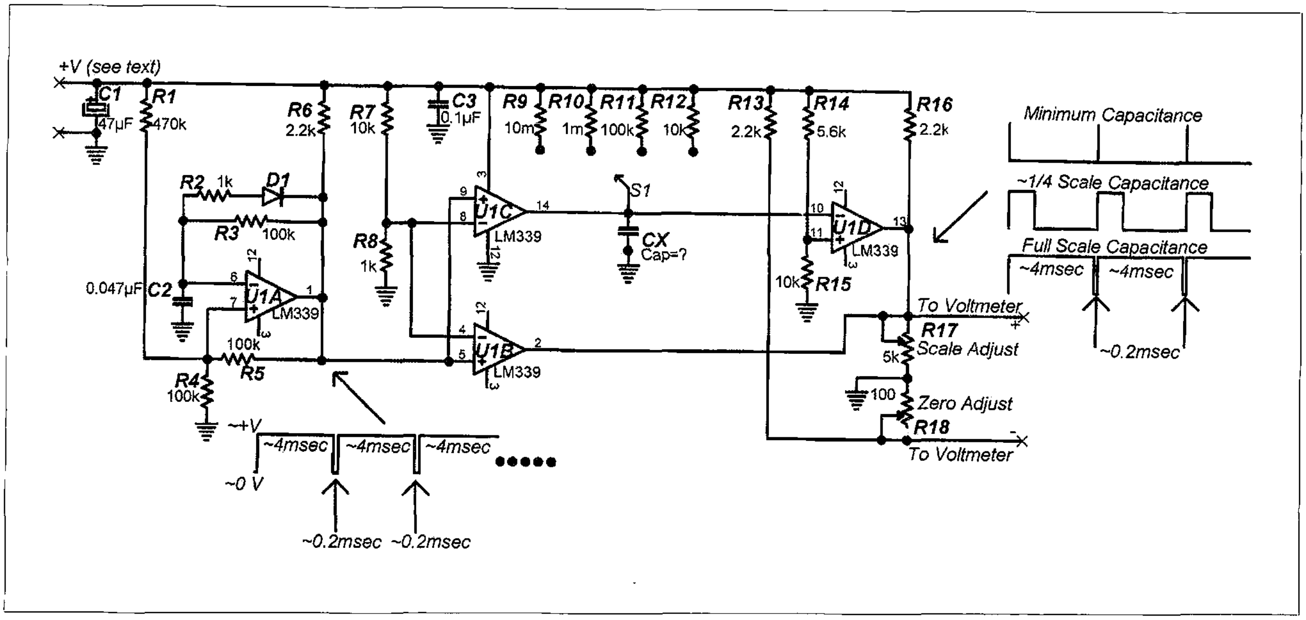


Fig. 1. Schematic.

high sub-microfarad range. The low end is limited by stray capacitance (although the measurement effects can be minimized with the offset adjustment) as well as the extremely high resistance values required. The high end is limited by the length of time required to discharge the capacitance value within the small reset time provided.

In the tester described below, the range is from approximately 100 pF per volt to 0.1 µF per volt. Increasing the high capacitance range is possible by increasing the off time allotted to discharging the unknown capacitor by increasing the value of R2 in the schematic. If this is done, however, the maximum output voltage will be decreased unless the on time is similarly increased by increasing R3. Because measuring high-value capacitors was not a goal of this tester, it was decided just to "live with" this restriction.

Circuit description

These basic concepts are shown in **Fig. 1**. Comparator U1A on the left part of the schematic performs the multivibrator function. Its operation can best be explained by first assuming the output at pin 1 of U1A to be open with a voltage close to the positive supply voltage (being pulled up by R6) and that capacitor C2 is at a low voltage. In this condition, capacitor C2 will be charging towards the positive supply voltage through R3 and R6.

When C2 reaches the positive voltage at pin 7 of U1A established by R1, R4, and R5, it will cause the output of U1A to go low (near zero volts). The time C2 took to reach this switching condition is primarily set by the 100 k resistor R3 and the 0.047 µF capacitor C2. When U1A goes low, C2 will discharge very rapidly through the 1 k resistor R2 and diode D1.

When C2 is nearly discharged, diode D1 ceases to conduct and the remaining discharge toward the low voltage of pin 1 of U1A is through the much higher resistance of R3. The function of resistor R1 is to ensure that pin 7 of U1A is more positive than pin 1 when pin 1 is near zero volts. When the discharge of C2 causes its voltage to fall below the voltage at pin 7 of U1A, the output at pin 1 again switches to its high level near the positive supply voltage level and the sequence repeats.

This repetitive sequence results in the highly asymmetrical multivibrator waveform shown on the schematic at pin 1 of U1A. This waveform is fed to the plus (noninverting) inputs of comparators U1B and U1C while a small positive voltage derived from R7 and R8 is fed to their negative (inverting) inputs to ensure noise immunity. When the input waveform goes above the small positive bias, both U1B and U1C become the equivalent of an open circuit to positive voltages (like an open collector of an NPN transistor). When the input waveform is below this bias level, the outputs of U1B and U1C are essentially at ground potential.

U1C is used to set the charge and discharge times of unknown capacitor CX, and U1B is used as a buffer for use as a "wired AND" with the output of comparator U1D as described below.

During the short interval that the waveform from the multivibrator is low, U1C is discharging unknown capacitor CX. During the longer interval, CX is charging towards the positive supply voltage through the selected resistor (R9, R10, R11, or R12). These resistors determine the charging rate of the capacitor and set the basic sensitivity of the capacity tester.

The voltage on CX is monitored by comparator U1D on the negative input of pin 10. When the voltage on CX is lower than the positive bias level established by R14 and R15 on pin 11 of U1D, the output of U1D will be open and its voltage set by R16 and the full-scale adjustment potentiometer of R17. With the values selected for R16 and R17, the highest output voltage will be about 0.7 times the supply voltage. If used with very low impedance

voltmeters, this maximum output voltage will be reduced but will not result in errors.

When the unknown capacitor has charged to a positive voltage equal to the bias voltage on the positive input of U1D on pin 11, the output of U1D will go essentially to ground potential. Thus, the length of time that the output of U1D is at a high voltage will be controlled by the time it takes CX to charge to this bias level, with larger capacitors yielding longer times.

Another interesting fact is that this maximum output voltage starts the instant CX is discharged below the bias level. This is an unknown time that is dependent upon the maximum input current capacity of U1D. The output of U1B is used to correct this problem by ensuring that the output of U1D cannot go high until the discharge cycle is over by using the "wired AND" capability of the 339 comparator. Thus, by connecting the output of U1B to the output of U1D, the output is forced to remain low until the short discharge period of the waveform is over.

An infinite capacitance or short circuit at CX, for example, will never charge up to the bias level and will, therefore, leave the output permanently at its maximum voltage except during the discharge period. This is the saturation level of the tester. The choice of R14 and R15 sets this bias level to approximately 0.64 times the positive supply voltage. This is very close to the value of 0.632 times the supply voltage obtained when time is equal to the RC time constant.

Because CX will be discharged every time the input waveform goes low (about every four milliseconds), RC time constants larger than that will exceed the full-scale capability of the tester. For example, if the one megohm resistor R10 is being used, a capacitor of 0.004 µF times one megohm equals the full-scale time of four milliseconds. It is important to understand this limit to ensure that it does not result in a measurement error.

Another issue is the residual capacity caused by the circuit as well as the test leads. At the highest sensitivity setting, when using the 10 megohm resistor R9, even this small capacitance can cause a very short pulse at the beginning of each measurement cycle with nothing connected to the test leads. This short pulse will result in a small measured voltage on the voltmeter. The zero adjustment potentiometer R18 is used to correct this error. Both full-scale limits and zero correction will be discussed later in the section on setup adjustments. The minimum, one-quarter-scale, and maximum output waveforms are shown on the schematic.

Circuit adjustment considerations

As stated earlier, the maximum limiting full-scale output voltage is approximately 0.7 times the supply voltage (~6 volts for a slightly old nine-volt battery, less a small zero adjustment).

Although there are many ways to adjust the capacitor tester depending on how you want to use it, the following approach seems to be the simplest and assumes the use of a nine-volt battery. My old analog voltmeter has low voltage scales of 0.6, 3.0, and 15 volts. I decided to use the three-volt scale and adjust the circuit for a scale factor of 100 pF/volt on the most sensitive scale (i.e., using the 10 megohm resistor R9).

Because the maximum limiting capacitance is approximately 400 pF, any reading within the three-volt scale (i.e., three volts at 300 pF) will be well within that limit. The adjustment for scale factor uses a "trusted capacitor" somewhere in the range to set the scale factor potentiometer. For example, I had a clearly labeled 220 pF 5% capacitor in my junk box and set the scale factor with that. The zero adjustment and scale adjustment are interactive, so you may have to iterate a few times. To achieve maximum accuracy, each scale should be checked (and re-adjusted as necessary) using known-value capacitors. For example, the adjustment on the next most sensitive scale using the one megohm resistor R10 would use a 0.003 µF capacitor or less to check/set the scale factor and zero adjustment.

This tester has been successfully used on the 0.6-volt scale for testing very small capacitors down to less

Parts List

D1	Diode (RS 276-1122)
R1	470 k (RS 271-312, 271-1354)
R2, R8	1 k (RS 271-312, 271-1321)
R3, R4, R5, R11	100 k (RS 271-312, 271-1347)
R6, R13, R16	2.2 k (RS 271-312, 271-1325)
R7, R12, R15	10 k (RS 271-312, 271-1335)
R9	10 megs (RS 271-312, 271-1365)
R10	1 meg (RS 271-312, 271-1356)
R14	5.6 k (RS 271-312)
R17	5 k pot (RS 271-1714)
R18	100 Ω pot (DK 36C12-ND)
C1	47 µF (RS 272-1015)
C2	0.047 µF (RS 272-134)
C3	0.1 µF (RS 272-109)
CX	junk box cap
U1	LM339 (RS 276-1712)
S1	Multi-pole switch (RS 275-1386)

Misc. Parts: 14-pin IC socket; 2"x3" perfboard; 4"x3"x1.5" enclosure; terminal posts; clips for CX

RS = Radio Shack (800) THE-SHACK
DK = Digi-Key (800) DIG-IKEY

Table 1. Parts list.

than 5 pF (where many of the mysteriously labeled junk box capacitors can be found). With a basic 100 pF/volt scale factor, the analog meter reading is full-scale at 60 pF. On this scale, it is quite sensitive to distributed capacity and several iterations will be necessary to set scale factor and zero adjustments.

Construction

The original version of this tester was built on a small piece of perfboard and had a single 10 megohm sensitivity resistor for small-value capacitors only. Other than the unsightly condition of the tester, it proved just fine for the limited purpose of checking low-value junk box capacitors. The latest "deluxe" version uses a switch to select the sensitivity resistors (R9 through R12), has terminals to connect the voltmeter, and is in a reasonably attractive plastic enclosure. The only known construction concern is to minimize the distributed capacitance associated with CX (i.e., U1C pin 1, U1D pin 10, S1, and the sensitivity resistors R9 through R12 as well as the leads to CX itself). 73

NEVER SAY DIE

continued from page 37

level of reading proficiency. Even our top students are doing poorly, placing *last* in a recent study of students in 13 countries in math and science.

I loved the front-page article in the *NY Times* about the city spending $185,000 in an effort to fire a teacher who was in prison for dealing cocaine.

If you've the interest to read some books exposing the corruption in our school system you may get as upset as I am over what we've let happen to our kids and our money through our inattention. I've written before about the school maintenance men who make over $80,000 a year and work three or four days a week. You and your kids are being screwed and you haven't even whimpered yet, so it's going to get worse.

Our kids are not even being taught to read and write. I wish you could see some of the pathetic letters I get from obviously almost illiterate people. A recent study showed that 47% of Americans have low levels of literacy. I believe it!

A Barnes & Noble study showed that about one book in ten that they sell actually gets read. And a study of our teachers showed that they read an average of one book a year. Fiction, of course.

In Kansas City they doubled the property taxes and poured $1.3 billion into the schools. Computers for two out of three students, pay raises for every school worker, including janitors, a $5 million swimming pool, and $1 million a year to promote the schools on local television. The results of this spending spree? The student scores haven't changed much. The dropout rate still is around 60%. The black enrollment when the spree started was at 69%. Ten years later it had zoomed to 70%, even though some students were now being taken to school by taxis.

Kindergarten for all cost a bundle, but it hasn't raised test scores later on. Well, it's a wonderful baby-sitting system, so the mothers benefit.

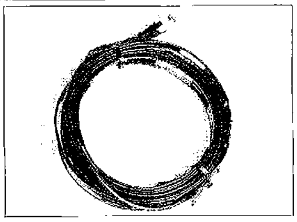
Richer

Both democracy and capitalism have serious downsides which we prefer not to think about. Well, like we say about our country, it has some terrible flaws, but even so it's better than any of the alternatives. So, mindful of that, I keep researching the reasons for our country's larger and more easily identifiable flaws and proposing ways to eliminate them. But eventually we're going to have to come to grips with the major problems

Continued on page 80

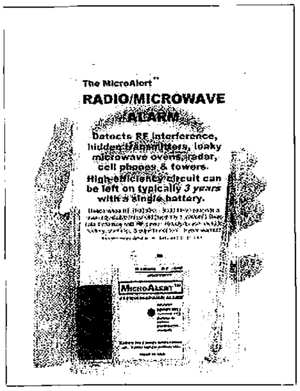
Number 72 on your Feedback card

New Products



TAKE ME ALONG!

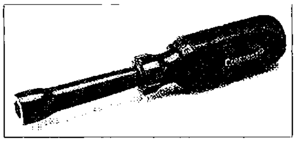
When you go on vacation, on a business trip, or even to the in-laws' place for dinner, be sure you go prepared—with the new MFJ-1736 six-meter J-pole antenna. Get base station performance anywhere; hang up the 156 inches of 450 Ω ladderline to get great QSOs; when you've had your fill of DXing or exploring exotic sporadic E, just roll it up and toss it in a corner of your briefcase. It works great with the MFJ-9406 (which you've got, of course!) or other six-meter transceiver, and naturally, it comes with MFJ's famous "No Matter What" warranty. To order, or for the name of your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfjenterprises.com]; or check out dealer and ordering information at MFJ's Web site: [http://www.mfjenterprises.com].



SEE — AND AVOID — INVISIBLE FIELDS!

The matchbox-sized Micro Alert alarm from AlphaLab, Inc., will let you find out exactly what's emitting radio or microwaves, whether visible or in hidden locations. At highest sensitivity (from 100 MHz to 5 GHz), it will detect a cell phone tower half a mile away, a cell phone 40 feet away, a digital phone 20 feet away — and strong sources of radio and microwaves that you might never suspect, like some wall outlets. An enhanced-sensitivity version (below 100 MHz) is also available for surveillance detection, if you're concerned about that.

The unit comes with a three-year battery and a one-year warranty, in three colors: black, gray, and off-white. It's priced at $81.50 plus shipping and handling. For ordering information, E-mail [emfmeter@webtv.net].

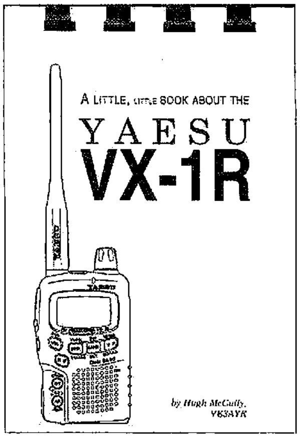


SPECIALTY NUTDRIVERS

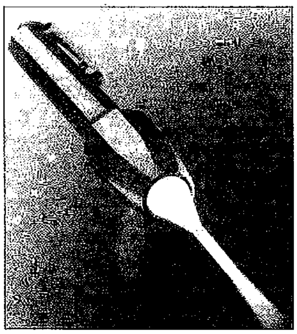
Got a Jensen Tools catalog handy? If your copy is dog-eared, maybe it's time to update. One recent addition to the catalog is the line of Crescent® insulated nutdrivers, with each unit individually tested for 1000 volts. These hollow-shaft tools are precision machined with case-hardened sockets and rubber cushion grips. They feature double insulation, red over yellow, so you can spot faulty insulation. The eight sizes of nutdriver (3/16-inch to 9/16-inch) comply with IEC900/ASTMF1505-94.

For information on Jensen Tools or a free catalog, contact Jensen Tools, 7815 S. 46th Street, Phoenix AZ 85044-9974. Phone (800) 426-1194 or FAX (800) 366-9662.

HE'S NOT KIDDING ABOUT THE TITLE



Yes, it's *A LITTLE, LITTLE BOOK ABOUT THE YAESU VX-1R* by Hugh McCully VE3AYR, a comb-bound pocket reference the size of a deck of playing cards. It contains virtually anything you'd ever want to know about the VX-1R in its 68 pages, and is handily organized from its table of contents to its index to answer all your questions instantly. Get your copy from Janus Computer Services, 610 Barons Court, Burlington ON L7R 4E4, Canada. The price we saw was $4.95, but since we don't know if that's US or Canadian dollars, or if it includes shipping, we suggest you either call (905) 333-0826, or E-mail [janus@bigwave.ca].

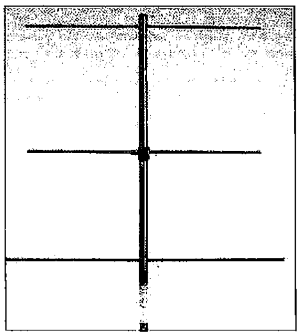


HEY! WHO TURNED OUT THE ...

Well, you won't have to worry about it. Here's Pelican Products' cool new Alignlite™—the world's first alignment tool with a light. The Alignlite's 6000 candlepower xenon beam (600% brighter than an ordinary flashlight!) illuminates even the darkest corners. It's submersible to 500 feet, and when the alignment tool is detached, you can use it as a pocket light.

It just keeps getting better! This little winner comes with two vision aid lenses (red and blue/green) *and* the batteries are included.

Contact Pelican Products, 23215 Early Avenue, Torrance CA 90505 and ask them about catalog number 1975. Call (310) 326-4700; FAX (310) 326-3311; or visit the Web site at [www.pelican.com].



NEW YAGI

Larsen Electronics introduces the new YA3220 line of yagi directional antennas. The compact three-element design offers a full 6 dBd (8 dBi) gain.

The new yagi is factory-tuned to cover the 220–225 MHz band at a maximum of 1.5:1 VSWR.

As with all Larsen products, the YA3220 is backed by a Three Year No-Nonsense™ warranty. For more information, see your dealer or contact Larsen Electronics, Inc., 3611 NE 112th Ave., Vancouver WA 98682. Call (360) 944-7551 or FAX (360) 944-7556.

Number 74 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

A classy approach to SSTV (and you get a free trial!)

A few months ago, an all-new SSTV program emerged using only the sound card in the IBM-compatible as an interface. Further back, in the January column, I mentioned success with W95SSTV. This was a predecessor to ChromaPIX, which is the topic of today's discussion.

These programs have the same authors and can be found on their Web sites. (See **Table 1**.) They are shareware that deserve a close look if you have even the slightest interest in slow scan TV (SSTV). I never did until this last year, when I found that the only interface I needed between my computer and the radio was either a pair of cables to a sound card (cost: $10 to $15) or a serial modem for maybe twice the cost. I have had great success with both.

I have been experimenting with digital signal processing (DSP) in the shack and the ChromaPIX authors claim DSP in their program.

Next month's column will center on DSP, but this program does a whale of a job of digging good, readable images out of the muck that piles up in the narrow slot on 20 meters (14.230 and 14.233) devoted to SSTV.

The presence of this program had been running around in the back of my mind. I just happened to run across a copy of it on CompuServe's Hamnet. Since it is a bit large at 5+ megabytes, I decided I would download it from there because I have a direct connection to a local node which is faster than from a Web page. Even that connection choked and took an extra 10 or so minutes, but now I had the real thing for a trial run.

Use the sound system on your laptop?

However, I didn't get around to it for several weeks. More busyness than I care to explain. The fun started when I decided to try it on the IBM laptop with its sound capabilities. There isn't a lot of info that comes with today's computers. The manufacturers have determined that none of us read the darn stuff, and those who do call to ask what the documentation means, anyway. The rest of us manage to stumble through and get these things working or go over the edge and make real smoke.

Anyway, the side of the little computer has jacks that have international symbols relating to "line in" and "line out," which is what I was looking for. I ran my cable from the speaker jack on the Icom 735 to the line-in and a cable from the line-out to the appropriate accessory jack on the back of the radio. I took a look and, sure enough, the spectral display was responding to the audio signal from the radio. This looked like a piece of cake.

Smoke ...?

You who have read this column before are waiting for the inevitable ... well ... it happened. No, there was no smoke. Everything appeared to work except that the received images were unreadable. All the buttons and menus responded and the included images would display and the editor controls would skew the colors and contrast into hideous proportions. I even tried a short transmit test and the program modulated the outgoing signal from the radio.

I wonder sometimes why I try things others wouldn't even think of doing. Must be something to do with mountain climbing, but that is a physical endeavor and it is different. Don't get me wrong. I never got into mountain climbing "just because it was there," and I don't have ill feelings toward those who do. My forays into the unknown are nearly always mechanical or electrical by nature. The local store is waiting for the day when I bring the charred and broken laptop back with a coax connector hanging out the side. (They told me just that a year or so ago.)

Since then, I have been in touch with Jim Barber N7CXI, and he sent a file explaining that some (many?) laptops are fine for handling regular audio. However, the demands of this program are a bit much. Jim did give a pointer that may help overcome the problem. Incidentally, where credit is due, the

RTTY Loop

continued from page 63

my trouble stems from some of the CPU/Menu settings on the FT-920 versus anything wrong with the PK232MBX."

Sure! Mentioned here a few months back, the GreenKeys reflector list may be just the ticket. Just send your question to [greenkeys@qth.net], and it will be sent on to hundreds of RTTY enthusiasts, both on and off the air. It is likely that one of them will be able to solve your problems.

Let's conclude this month's column with a story. Captain Paul Wolboldt, CAP, passes along the following tale:

"I have been reading your column for a couple years now—I think, since I arrived here from Hawaii in February 1996. You have a great column. *[Thanks ... MIL.]* I had been a crypto equipment repairman in the Air Force for many years before my discharge from the service. In July of 1994 I signed on with the Hawaii Army National Guard in a combat support battalion. This tour lasted until I left there in February 1996. The interesting thing that had happened to me was that I had been assigned to repair teletype equipment/terminals. About two months before I left, the unit was inventorying all of their equipment because they were changing missions and wanted to turn in all of their old equipment. We pulled out two big travel boxes that were labeled "teletype." Having worked around the teletype guys in the USAF I thought they might be some sort of Model 28 type of gear. Nope. Inside each box was a brand new Kleinschmidt—in perfect condition, not a scratch to be found. They even *smelled* factory-new. The ribbons had never been used. Good thing no one asked me to work on them. I didn't have any books or tools for it. I doubt the company has them since it has been two years. I guess old stuff will turn up in the strangest of places for a long time to come."

Yes, Paul, I agree; you never know where something will turn up. This summer, I have been going through my basement, and I have found stuff that has been lost for years—which is not to say my wife let me *keep* it, just that I could say, "Oh, that's where it's been," before throwing it out!

Check that "RTTY Loop" Home Page, for pointers to all the stuff I've been talking about. You never know what you might find!

Current Web Addresses	
Source for:	**Web address (URL)**
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free programs	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom - German site	http://www.baycom.de/
Pasokon SSTV programs & hardware	http://www.ultranet.com/~sstv/lite.html
Winpack shareware for Windows	http://www.duckles.demon.co.uk/ham/wp.htm
Baycom 1.5 and Manual.zip in English	http://www.cs.wvu.edu/~acm/gopher/Software/baycom/
Tucson Amateur Packet Radio—where packet started—new modes on the way	http://www.tapr.org
TNC to radio wiring help	http://prairie.lakes.com/~medcalf/ztx/wire/
ChromaPIX & W95SSTV	http://www.siliconpixels.com/
VHF packet serial modem kit	http://www.ldgelectronics.com

Table 1. *Current Web addresses. All of the above were cut and pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later.*

co-author of the program is William Montgomery VE3EC.

Good stuff on the Web site

Back to the story: I read all the info I had gathered on this laptop installation and there was nothing that said it couldn't be done. The next stop was the Web site, which contains recently updated material including a new manual and a frequently asked questions (FAQ) file.

The FAQ file was interesting because it answered a question I received from Jay WA3IFY. He had wondered about getting his W95SSTV program to key his transmitter automatically when he clicked the "Transmit" button on the screen. In this file is a keying interface to accomplish just that. My lazy-man's way was simply to put the transceiver in transmit mode manually, then click the program to send the image. That works, but most would like a little more sophistication in our equipment.

There was also an updated version of the ChromaPIX software with a patch file to update the previous beta version. I downloaded and printed all this valuable information. It is very well written. A word of advice, though. In my first printing of the manual in black and white, the images printed poorly.

Next time I printed in color, which definitely improves comprehension. If you have color capability, use it. The manual is in the *Acrobat* pdf format. It is a classy way to produce a very nice document that reads the way it was designed. The *Acrobat Reader* program is available at no cost and there is a link from the Web site if you don't already have a copy.

After reading the material and installing the update patch to the program, the incoming images were not improved. It was time to put the workhorse desktop to the task. Installation went well. For some reason, the screen fit the monitor better. On the laptop, I was not able to get the screen to maximize.

A quick check of the incoming signals showed that they were getting weaker as the evening progressed, but the spectral display said they were there. One small problem ... the received signals weren't decoding at all ... there was no image display.

Heed those warnings

Then came a warning display window from First Aid 98™ telling me my resources were low. Interestingly, after going to the recommended First Aid 98 window and picking a lower percentage threshold for the warning signal, pictures began to appear!

All was well. I was surprised to see the activity on SSTV so late in the evening. I had assumed everyone folded their tents about dusk. I stand cor-

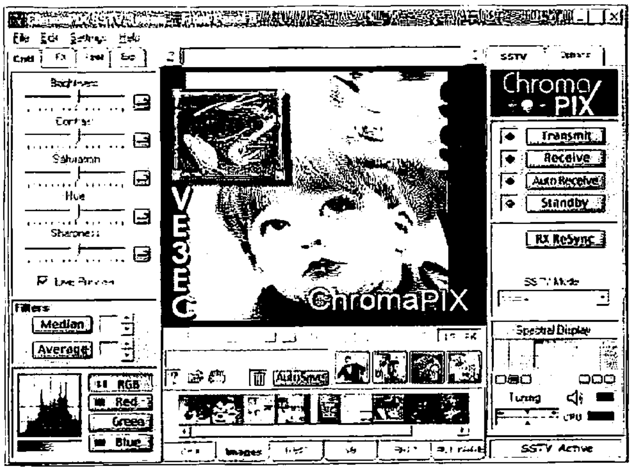


Fig. 1. *Scanned from the manual, this is what the program looks like on your monitor. At lower right are tuning aids. Above those are the mode choice menu, and then the transmit and receive buttons. At middle bottom is file handling, and to the left are controls for editing the image. Clicking tabs gives access to more features, including received image filtering and more editing choices. I tried a live screen save to the clipboard, but the quality was very poor, so I couldn't display actual received images. Nonetheless, incoming images are excellent.*

Mode	Sound	Where to Listen (MHz)
SSTV	Steady warble (more like a small tree full of birds)	3.845; 3.857; 7.171; 14.230; 14.233; 21.340; 28.680; 145.5
RTTY	Two-tone, often varying but steady at occasional idle when no info being sent	3.605–3.645; 7.08–7.1; 10.14–10.15; 14.07–14.1; 18.1–18.11; 21.07; 21.1; 24.92–24.93; 28.07–28.1
PacTOR	Pulsating single tone warble approximately every second when linked	3.625–3.63; 7.07–7.85; 14.065–14.08; 21.07–21.09; 28.07–28.09
* FEC	Similar to RTTY; used in AMTOR and PacTOR modes	Detect while in "Listen" modes on above PacTOR frequencies
AMTOR	Rapid pulsating two-tone for send/error-check when linked	Not heard much since PacTOR came along and is using the same frequency ranges

Table 2. *Here are places to look and sounds to listen for. It is difficult to describe sounds that I can't quite make with my mouth. In some cases, it would take two people whistling simultaneously to approximate what you will hear, but this is information that seems to be left out of the reference books. GTOR is similar to PacTOR in sound and frequency. WEFAX? I have copied some once upon a time, but I can't recall the sound. There are frequencies usually listed with the software. *FEC (Forward Error Correction) is used to call CQ. However, when a link can't be maintained, it provides an alternative mode of communication that may require repeated messages.*

rected. The outstanding image of the evening came from an Italian ham who was having an image-only QSO with a ham on the east coast. That was the best image I had seen thus far, at any time of the day, from Europe.

This was also a first time for me to observe a contact being made without voice monitoring between transmission of images each way. That seems like a natural way to go and I am sure others do it. Maybe they are labeled "purists."

The installation is straightforward. If you follow the written instructions, the program installation takes care of itself like a good Windows 95™ should. You will find the beta version is not crippled except for one thing. It will only run for 30 minutes at a time until you register it. A few sessions will give you a good idea about whether this is the program for you. So the trial run is cheap: the price of two cables. And if you have a few plugs, you can use any decent audio cable. I had some extra cable when I first hooked up the sound board, so it was relatively painless.

As far as cable connections go, the instructions on the Web site will tell you all you need to get up and running. Some digital connections will work just fine from the accessory port on the back of the Icom 735. The serial modem and the PK232 both function well with the incoming audio at a low, nonadjustable level, but the audio to line-in on the sound card requires speaker output. The line-out goes to the pin that goes to the modulator stage, plus a ground of course. (Consult your radio manual.)

You will find that the 18-page manual is an easy read that points you toward the various controls for filtering, editing, and repairing images. It is really an impressive array of controls that makes SSTV easy, fun, and inexpensive, especially when compared to systems available a few years back.

In **Table 2** I mention the 20 meter band frequencies at 14.230 and 14.233. There are others, though not so popular, where you will also find activity. A few weeks ago, I was tuning across 10 meters and came upon an SSTV warble at 28.680. I listened a few minutes and heard something that sounded a bit like Spanish, so I hooked up the modem and got an image featuring a map of Brazil in the background! It was Portuguese they were speaking!

The frequencies where you are most apt to find SSTV are listed in **Table 2** along with some other info. The reason for this chart was a request from a ham recently because he had purchased a great multi-mode TNC and didn't have a clue where to find the signals nor what they might sound like.

He was suggesting that I publish this information in the column, and I thought that was a very good idea. There is a time in everyone's life when we are BRODS (Before Recognition Of Digital Signals—didn't we need one more acronym?), and if we want someone to listen and talk to us, we had better let them know where we are. Sounds simple.

This has been a good month. The SSTV program was a lot of fun to experiment with. In his note, Jim expressed his desire to warn those who try the program that it is a beta version and is still "in process." Read the system requirements listed on the Web site to see if your computer can handle the load.

I appreciate the E-mail contacts for information and suggestions. It helps me to know what you want and how close on track I am. Plus, every now and then, someone points out one of my many missteps. That is good for me—it keeps my ego in control. Talk to you next month.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, when you get a chance, drop me a line [KB7NO @ N7NPB.#NONEVNV.USA.NOAM]. For now, 73, Jack KB7NO.

Hams with Class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Teachers' Workshop at Dayton

The Teachers' Workshop at the Dayton Hamvention® was filled with a wonderful exchange of really good creative ideas for instructors and teachers. My good friend Gordon West WB6NOA stopped by to remind the audience how important it is to have a ham radio teacher who is lively and enthusiastic. This is especially important when working with youngsters. With all the competition out there today for the children's time, it's important that we motivate and sustain their interest in radio.

Gordon and I plan to resume our "CQ All Schools Net" in September on 28.303 MHz on Tuesdays and Thursdays at 12:30 p.m. eastern time. We invite all to join us and get on to speak with the school kids.

Next, Dave Bell W6AQ gave a little talk about his work as Chairman of the ARRL Public Relations committee. He held the audience spellbound when he showed a videotape about DXpeditions which included recent footage from Heard Island. He gave suggestions about how to incorporate videos like this and other exciting ham radio contacts into classroom lessons. A copy of this video may be gotten free by writing to: Northern California DX Foundation, P.O. Box 2368, Stamford CA 94309-2368. I heartily recommend using it as a motivational and informative lesson in a classroom.

Richard Sandell WK6R, who has among his numerous accomplishments the fact that he was a college professor for many years, was my next speaker. During those years he personally brought more than 3,000 new hams into the hobby. He stresses how important it is to always have the mindset of a recruiter. "Ask," he says, "would you like to join us?"

Richard feels, like many of us, that the Internet cannot replace what we as ham radio operators have. The thoughts and emotions that we exchange easily with each other are not so easily traded on the Internet. In his own family, Richard told us that bribery worked very well with his three daughters and his wife. Whatever works! Richard continues to be a tremendous asset to ham radio by keeping the Hudson Division hams and others well informed through his publishing of the *Hudson Loop*. This service is available by free Internet subscription. To subscribe, send an Internet E-mail message to [subscribe@hudson-loop.org] and type "Subscribe Hudson Loop" on the subject line.

Rosalie White WA1STO is the head of the Education Activities Department at the ARRL. Rosalie offered the services of her department to those who are teachers or instructors. She displayed several of the League publications, highlighting those that deal with recruiting ideas and classroom techniques.

One of the teaching ideas she shared with us is the use of wooden blocks to show kids the progression of a block diagram or the building of a circuit. Rosalie informs us that *QST* magazine runs a series of articles about teaching ideas. Be sure to consult with her office or go to ARRL on the World Wide Web at [http://www.arrl.org/] if you are a teacher looking for ideas.

My next speaker was the dynamic Bob Heil K9EID. Bob is always a great motivational speaker for an audience of teachers—he has so much respect for teachers and the profound influence they have on their students. He is a proponent of the exciting, lively lesson and demonstration technique in the classroom.

Bob is a multi-talented individual with a tremendous list of accomplishments to his credit. He traced for us how his involvement with ham radio was responsible for the many wonderful opportunities he has had in his life.

Bob came up with several interesting suggestions about promoting your ham radio classes. One of them is to contact local TV talk shows. A visit to your classroom where children are involved with wholesome and unusual activities may be just what the local TV show producers may be interested in presenting.

On Staten Island, where I teach, there is a local cable company that has a community programming division. My ham radio classes have been featured several times over the years. You should make your class situation known to these local stations. There may be a need for a "filler" one day, and the station may call you to give you a chance. It's definitely worth a try.

My last guest speaker was Bill Pasternak WA6ITF. Bill is a tireless worker for recruitment of young hams. He is the number-one spokesman for the "Young Ham of the Year" award. Bill invited everyone to be on the lookout for enthusiastic youngsters who are actively involved in the hobby. Nominees for this award should not be children who have gotten licensed just to appease a parent or a teacher. There are so many talented young people out there. Let's all be supportive of them when we meet them on the air—and keep Bill in mind when this award gets publicized in a few months.

You might also want to keep *me* in mind by referring these children to me for an interview for the next Dayton Hamvention Youth Forum. My column next month will feature the wonderful young people who participated in the Youth Forum this past May. CU then. 73

Secrets of Deviant Behavior
continued from page 20

diodes D1 and D2 charging capacitor C4 to a peak voltage value. Two FETs are used to isolate this detector from adjacent low impedance circuits, with transistor Q1 providing a very light load on the receiver's FM detector. Transistor Q2 is operating in one leg of a bridge circuit and functions as a meter driver. Pot R8 is used to zero the meter when the gate of transistor Q1 is momentarily grounded. The circuit was implemented using 2N5245 transistors, but it is believed that others such as the 2N3819 and 2N4416 will work as well.

In conclusion, an FM receiver or scanner may be used for measuring or monitoring frequency deviation of an FM transmitter. Implementation is accomplished by connecting a scope or peak-reading AC voltmeter to the DC output of the receiver's FM detector.

An FET Probe to MMIC
continued from page 49

are not to scale and must be fitted to the user's desired packaging envelope. Copper trace widths may be adjusted to obtain any desired board profile.

Mounting the FET probe in a Sharpie pen case worked out well with the probe tip pushed into the cap (which is slightly wider than the pen body). Narrowing the board as much as possible will allow the board and large components to slide into the pen body. A hole is drilled in the center of the pen cap to allow the probe tip to pass. The closed end of the pen body is drilled with a hole large enough for the power lead, ground lead, and RG-174 coax to pass.

Because of the high-frequency attenuation factor exhibited by the RG-174,

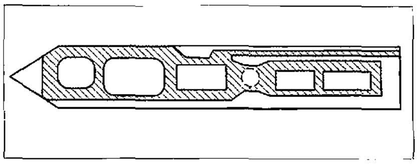


Fig. 5. *Single-sided printed circuit board layout for the FET probe with Mini-Circuits MAR-1 or MAR-2 MMIC.*

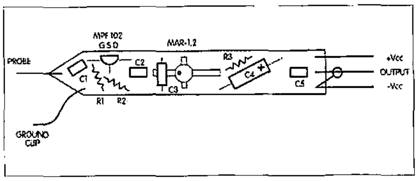


Fig. 6. *Parts layout for FET probe using a Mini-Circuits MAR-1 or MAR-2 MMIC.*

its length should be kept as short as possible. Also, to reduce reflections and to achieve the best signal transfer between the probe and the equipment in use, the equipment end of the coax may require an impedance termination.

A coax tee with a non-inductive resistor on one port is usually sufficient to achieve the desired match. The value of the resistor would typically be 50 ohms to match the probe and coax impedance. But in the case of the FET probe, the resistor value should be determined experimentally since the equipment's input impedance is a factor in achieving the proper match. In some of my experiments, it was proved better to have no matching resistor attached—which, again, provides room for user experimentation.

In operation, I found that my FET probe using the UPC1651 operated best at 4.5 V in order to achieve the best wideband performance. I recommend a trial test run in which the V_{cc} is varied from about 3–5 volts in order to find the best point of operation for your project. Some versions of MAR devices other than the MAR-1 and MAR-2 require a slightly lower supply voltage than does the UPC1651, which needs five volts.

The FET probe is easy to build and can be an asset to your test equipment and the experiments you perform. Give it a try! Both the circuit and the board layout for each is shown to provide you with construction options.

QRX
continued from page 7

10-meter high power capability would be the easiest thing by the next *CQ* 10 Meters Contest. And the extra money might allow him to add computer contest logging ...

The stranger frantically finishes writing the check and waves it in front of Jake. "Here it is, ready to hand to you right here and now. $15,000. Take it or leave it."

Jake abruptly makes his decision. "OK," he says, and peels off the watch.

They make the exchange, and the stranger starts happily away.

"Hey, wait a minute," calls Jake after the stranger. The stranger stops and turns as Jake points to the two suitcases he'd been trying to wrestle through the bus station. "DON'T FORGET YOUR BATTERIES!"

TNX to *The Propagator,* West Palm Beach ARC, Inc., June 1998, Sam Falco KD4VBI, editor.

Heart Problems

If you think you have RFI problems, a Dallas, Texas, television station has you beaten by a city mile. When it turned on its new high-definition transmitter, it caused the wireless heart monitoring system at the Baylor Medical Center to lose all patient contact. According to news reports, no patients were injured during the system outage. The station involved, WFAA, did agree to suspend operations of the new transmitter until the hospital monitoring system was moved to a new set of frequencies not prone to digital television interference. But the shutdown of wireless heart monitors following launch of DTV service in Dallas is almost certainly a harbinger of similar problems elsewhere.

According to *Communications Daily,* the problem centers on the fact that many hospitals have wireless systems which relay patient heart activity data to nursing stations. This lets the patients roam about. Unfortunately, many of these systems rely on previously unused television channels which just now are being occupied by new digital television signals. Moving all the heart monitoring systems will be an expensive proposition for the nation's hospitals, and the heart monitors are not alone. Many other types of wireless systems are believed to use currently unused DTV channels as well.

From *AARC/OVER,* newsletter of Austin ARC, April 1998, Lloyd Crawford N5GDB, editor.

Radar Love

If you're single, you can use radio technology to help find a partner—as long as you're in Japan. "Lovegety" is a small unlicensed radio transceiver attached to a keychain. The $25 gizmo acts as a personal beacon to attract someone to

chat with, a karaoke singing partner, or a mate, depending on switch settings. Hundreds of thousands of units have been sold.

The Lovegety (or "Love-G") has an egglike enclosure with a bottom section that indicates its gender (blue for boys, pink for girls). A Lovegety will beep and flash when it detects another Lovegety, as long as the units are switched on, within close range (about 15 feet), and of the opposite gender. (Some advertising for Lovegety poked fun at a man who wore lipstick and carried a ladies' Love-G.)

The manufacturer, Erfolg, is said to be developing additional models, some with longer range, voice capability, and even a display of personal information.

The company intends to market Lovegety in Britain and Hong Kong. So far, we haven't heard any plans to market the device in the US. If Erfolg does set its sights on the US, we recommend that it employ some better advertising copywriters. Here is a sample of the company's English-language promotional material:

"When a man has LOVEGETY, when a woman having LOVEGETY approaches the man, each LOVEGETY reacts, and a sound sounds. It is the product which can inform opponent of a feeling of oneself even if you do not speak this. If you are the person who is not readily invited to a woman, it is the most suitable product. Or it is the product which is most suitable when you demand an encounter with a woman different from usual. Therefore I use it, and you can be excited by a feeling of the time! There is residual various kinds of usage. Find it pleasantly hard together!"

More about Lovegety at [http://www.kishina.com/lovegety2/].

From the *W5YI Report*, June 15, 1998, Fred Maia W5YI, editor.

Another Science Lesson

When I got my two-meter HT, I also bought an extra battery so I could be charging one up while I was running the other down. Over a period of time, both batteries have been used about an equal amount of time, used under similar conditions, and recharged about the same number of times. With this in mind, I found it hard to understand why one battery would hold a charge for an extended period while the other battery seemed to drain off in nothing flat. I have pondered this situation for some time now and have come up with a theory. It goes something like this:

Most people don't realize that electrons come in two kinds—male and female. My one battery, the one that holds a charge, had both male and female electrons placed in it at the factory. When the radio is turned on, the electrons become excited and actually produce more electrons. With these additional electrons available, the battery will hold a charge longer. Eventually, however, the interbreeding of the electrons produces a lower-grade electron and a complete recharging finally becomes necessary.

The second battery, the one that won't hold a charge, had only male electrons placed in it, as a result of an error at the factory when the battery was built. With this battery, when the radio is turned on, the male electrons get excited but with no females around soon abandon the battery, leaving it dead. These male electrons usually fall to the floor, where evidence of their existence can be found when we walk across the carpet and pick up static electricity.

Adapted from a piece by Ken Jones WD9IBJ in *Bandbits*, newsletter of the Peoria Area ARC, Vol. 12., No. 4, James F. Williams N9HHU, editor.

1.2 GHz Threat

The ARRL has learned that the second civilian frequency for the global positioning system (GPS) could wind up within amateur radio's secondary allocation at 1.2 GHz. A decision on whether the new, second frequency will be 1205 or 1250 MHz is expected to be made in August. An allocation at 1250 MHz could mean the end of amateur radio in the band 1240 to 1260 MHz. The amateur radio 23 cm band runs from 1240 to 1300 MHz.

In February 1997, the Department of Transportation and the Department of Defense announced an agreement assuring civilian GPS users of a second frequency—referred to as L5 and considered essential for critical civilian GPS uses. According to a DOD news release, the White House Commission on Aviation Safety and Security, chaired by Vice President Al Gore, "called for the establishment of a second civil frequency as part of a broader program to maintain US leadership in aviation and satellite technology."

From *The ARRL Letter*, Vol. 17, No. 15; April 10, 1998, via Spring 1998 *Packet Status Register*, Bob Hansen N2GDE, editor.

Top 10 Signs You've Over-Modified Your Scanning Receiver

1. Houston Mission Control drowns out the local repeaters.

2. Your radios glow in the dark. Even when they're not plugged in.

3. The NSA calls to get copies of transmissions they missed.

4. Commercial airline pilots use your antenna array as a landmark.

5. Your wife says "Either that thing goes or I go. Over ..."

6. Your rooftop, car trunk, and back yard are collectively referred to as the "antenna farm."

7. SETI calls you to confirm signals from Orion.

8. You dial in frequencies that Stephen Hawking says don't exist this side of a black hole.

9. You hear voices talking about invading the "third planet from the star."

10. Your "LOW BATTERY" indicator glows constantly, even when you're operating on AC.

By Bill WB1BRE, from *ARNS Bulletin*, May 1998, Steve Auyer N2TKX, editor; originally printed in *Key Klicks*, newsletter of the Green Mountain Wireless Society, Deborah Clark NN1C, editor.

Air Safety Pirate Walks Plank

The FCC has closed down another unlicensed radio station, after the agency received complaints that its signal was interfering with commercial

Continued on page 88

Never Say Die

continued from page 71

our fundamental systems have — or suffer the consequences.

If you'll put down that flag you've been waving for a minute I'll explain what's wrong with democracy. No, I'm not pushing any of the alternatives I'm aware of. Socialism and its sisters communism and fascism have all been tried and found to be horrible failures. Feudalism didn't work either.

Democracy, at least, is in tune with Darwin's survival of the fittest concept in that the will of the people is determined by a vote. And that means that 51% are able to dominate 49% of any differing opinion. Dominate and gradually eliminate. As our politicians have discovered, the way you get that 51% is to be better at manipulating the people. They use the media and your money to do that to you.

The bottom line, which we don't want to think about, is that democracy is a system which tends to make the rich richer and the poor poorer — since the media are firmly in the hands of the richer.

Capitalism tends to compound this problem.

Big companies, driven by the need to constantly expand, grow by gobbling up smaller companies. Rockefeller exploited this, as has Microsoft. We see it in the megamergers and the growth of international megacorporations. We see it in banking, and every other industry.

Many years ago a chap who worked for me had built a small grocery chain in Connecticut. Then a larger chain put in stores near his, one by one. Each time they'd sell groceries at below cost for as long as it took to put his store out of business, then they'd raise their prices above what his had been charging. One by one they wiped him out.

When a WalMart™ store goes in it quickly wipes out a dozen or more smaller merchants, usually killing the downtown part of towns. When I was a kid there were mom-and-pop groceries everywhere. Now they're all gone, replaced by a few supermarkets, and the old groceries are now boarded-up storefronts.

Rockefeller grew by his Standard Oil's systematically gobbling up smaller oil companies.

But what about the government's trust-busting activities, you ask. My answer is to ask you: Who do you think is running the government? And you know the answer as well as I do — money runs the government. Money runs the presidency. Money runs Congress. Money from those who have it in large quantities and

buy the support of our politicians, who need that money to keep their jobs through very expensive re-election campaigns.

The rich in our country have been getting richer and the poor poorer, if you've been reading the surveys. And this is only going to get worse.

The thousands of small car companies of 90 years ago shrank to about four. Then, as international transportation and communications costs came down, the number of car companies grew — for a while. Now we're seeing international car company megamergers with Jaguar and Mercedes Benz joining Ford and General Motors. We'll be seeing more, getting us back to four. Then three. Then, eventually, one.

Twenty years ago there were thousands of small personal computer companies. By 1982 there were over 2000 small companies supplying add-on hard and software for the Radio Shack™ computers. I was running over 300 pages of ads for these products every month in my *80-Micro* magazine. Then IBM came along and wiped out the Radio Shack computer and all those companies either changed to supporting the IBM PC or went out of business.

And so it goes in every industry. Capitalism works great for smaller businesses, but once they get big they tend only to get bigger by gobbling up the small guys, often using despicable methods. Call it the industrial food chain.

RCA got big by subcontracting out small jobs. Then they'd make the next order bigger. Finally they'd place a huge order and then, just before delivery, cancel it. Then they'd be able to buy the company cheap when this bankrupted it.

I once explained in an editorial how Radio Shack managed to get so many company-owned stores so inexpensively, and the president never forgave me.

Democracy is a pretty good system. Beats a king or dictator. But it's still a system that doesn't give much of a voice to minorities — unless they really raise hell.

The Pepsi Generation

There's been a lot of tsk-tsking about what's gone wrong with kids these days. Golly, they're taking guns to school and killing each other. What, oh what, has gone wrong with our society, ask the hand-wringers. Is it the plethora of violence on TV and in the movies? Is it the lack of parental guidance, with both parents having to work to make ends meet?

Sure, those are contributing factors, but I suspect the more basic root of what's gone wrong with not just our kids, but with our society in general, is both well hidden and politically untouchable by the media and our government nannies. Just look at how long it's taken for Congress to even consider doing something about the death toll from smoking! That cigarettes are killing us has been no secret for the last 40 years. Heck, over 30 years ago I was handing out book matches which said "*73 Magazine* Cancer-Free Matches." One of the largest makers of book matches, D.D. Bean, over in the next town, made 'em for me specially so they couldn't light. Ted Hommel W7LFL, who'd worked for me when he dropped out of college, was working for Bean and organized the special project.

Getting back to what I suspect is the strongest factor in influencing our kids' rotten behavior, which you won't want to believe — at least until I can get you to do your homework on the subject so you'll see that, no matter how much you hate the idea, that I'm dead right on this one. It's refined sugar.

I first read about this almost 50 years ago, but my addiction to sugar was so strong by that time that I didn't do anything about it. Oh, my mother did a great

Continued on page 82

NEVER SAY DIE

continued from page 81

job of starting me off right. We never had any white bread or jam on the table. I had hot cereal or eggs for breakfast most of the time, with pancakes, scrapple, fried mush, or corn fritters and syrup on rare occasions. It wasn't until I went away to St. Paul's choir summer camp that I got introduced to jam, jelly, and white bread. Thanks a lot. And this continued later at the frat house in college.

So what's wrong with sugar? Oy, what a list! Please stop being cheap and invest $6 in *Lick The Sugar Habit* by Nancy Appleton, Avery Publishing ISBN 0-89529-695-0, 1996, 256 pages. If your local bookstore doesn't have it, you can get it from Radio Bookstore #5745, 800-243-1438 (tell 'em Wayne sent you and that if they know what's good for them they should have Laura Lee interview me again). That's not my Radio Bookshop, by the way. I should sue 'em for coming too close to my mail-order book company name. I started Radio Bookshop in 1958 and it's still going.

Now, about what sugar does. It suppresses your immune system, thereby making you more susceptible to any illness going around, plus cancer, and so on. It upsets your body's mineral balance, leading to osteoporosis, arthritis, and a bunch more horrible illnesses. It often causes hyperactivity, crankiness, anxiety, and loss of concentration in children. It can also cause drowsiness and decreased activity in children. It affects children's grades. It can cause kidney damage. It can lead to cancer of the breast, ovaries, prostate, and rectum. It can weaken eyesight. It can narrow blood vessels, causing hypertension. It can cause hypoglycemia. It can speed the aging process, causing wrinkles and gray hair. It certainly promotes tooth decay. It sure contributes to weight gain and obesity. It can cause asthma, yeast infections, gallstones, kidney stones, heart disease, appendicitis, hemorrhoids, varicose veins, diabetes, food allergies, toxemia during pregnancy, cataracts, cardiovascular disease, emphysema, loss of skin elasticity, damage to the liver and pancreas, constipation, nearsightedness, tendon brittleness, headaches (including migraines), and depression. It can even alter the brain's ability to think.

If you think I'm exaggerating, check out the medical references backing up every one of those claims in the book.

Sugar is a serious poison, made all the worse because the effects are delayed. This is what it took to finally get me to swear off sugar and I've been off it since the first of January this year.

That's right (sob), no more Haägen-Dasz coffee ice cream (whimper). No more apple pie or other desserts. No more Lindt absolutely fabulous chocolate.

If you are so seriously addicted to sugar that reading the above book doesn't stop you, then invest another $6 in William Duffy's *Sugar Blues*, Warner Books, ISBN 0-446-34312-9, 256 pages, 1975. Duffy adds to the list of things sugar does to us, such as contributing seriously to alcoholism and drug addiction. He also shows that sugar is a basic contributor to schizophrenia. I once knew a woman who'd been brought up having coffee, white toast and grape jelly for breakfast every day for years. She was a real mess, with long depressions and suicide attempts that several hundred thousand dollars of psychoanalysis didn't help. She alienated her parents, sister and even her daughter. Well, I said she was a mess. Worse, she eventually married a total loser, who I think was more interested in the money she stole from her first husband than in her.

If you'll look at the list of ingredients on packaged foods you'll find that sugar seems to be everywhere. Sugar, dextrose, and other similar disguises. It's very difficult, if you eat the usual supermarket food, to avoid sugar. Most of your cold cereals have sugar in them, and that's not counting the sugar-frosted babies.

What have I been eating? For breakfast I have a bowl of hot cereal (with a little cream), a banana, and an orange. I also chug down a half cup of V8™ juice with a heaping teaspoon of cayenne pepper and another of minced garlic. They're both supposed to be good for you, and followed by some cereal, the cayenne only burns for a moment.

People who drink Coke™ or Pepsi™ are getting big slugs of sugar and they're getting sick and tired. That's our Pepsi Generation for you, thank you.

The next time you feed your kids cold cereal, ice cream, a milk shake, soda pop, or cookies, just remember that you are pushing them on the road to diabetes, brain loss, and a host of potential chronic illnesses. You can trigger asthma, allergies, and so on. If you absolutely can't help going to a fast food place, at least make it a Wendy's™ with a salad bar.

Nuclear War

Now that the USSR is split up and the Russian government is busy trying (and failing) to cope with their new *Mafiya* and so many people not paying taxes, they're certainly not going to be attacking the US with nukes, right? We know there's no problem because President Clinton told us that our children are now growing up free of the threat of a nuclear holocaust. I know you are probably not going to believe me if I say that Clinton was not telling the truth. Our president wouldn't lie to us, would he?

A special report in the *New England Journal of Medicine* in April this year estimated that an accidental launch of nuclear weapons from Russia would kill 6.8 million Americans instantly and expose millions more to a lingering death from lethal radiation. The report said that the likelihood of such an accident is increasing with time, not diminishing.

The Russians have about 2,500 nuclear warheads ready to be launched. The US has even more aimed at them, and all of these can be targeted in seconds. The Russian nukes are programmed so that if they are accidentally fired without a new target being set they will automatically go to their Cold War targets. Well, there goes an American city, right? Or six, considering their use of multiple warheads.

It's worse than that since neither their nor our missiles have any self-destruct system built in, so that once they are on their way, that's it. If that isn't enough for you, both countries have their missile systems programmed to "launch-on-warning." This means that neither country is going to wait for any suspected incoming missiles to hit before retaliating. Heck, by then it might be too late, if the missiles' targets include our missile sites (which they do). The launch-on-warning allows just a few minutes for top-level decisionmakers to abort the retaliation. Both nations have nuclear-armed submarines within 15 minutes of their targets, so the decisionmaking time is short.

In January 1995 Russian radar operators spotted a rocket rising off the coast of Norway. President Yeltsin was alerted and quickly activated his "nuclear response suitcase," the unit which would allow him to launch a counterstrike. With less than four minutes to spare the Russian officials found that the rocket's path would take it out over the Atlantic Ocean, so the crisis passed. It turned out to be a scientific probe and that the Norwegians *had* notified the Russian authorities weeks before of the planned launch, but the message hadn't gotten through the Russian bureaucracy.

An article in *Scientific American* (Nov. 1997) pointed out that the controls of the Russian nuclear missile systems are failing and that there have been several occasions when the computers have switched to combat mode for

no known reason. Worse, as you've probably read, many of the Russian military haven't been paid in months and the CIA says that there have been conspiracies within nuclear armed units to commit nuclear blackmail.

The CIA also reported that morale has broken down even among the elite submariners and that some sub crews may be able to launch nuclear missiles without getting the special codes from their superiors.

The Russian defense minister recently warned that "if the shortage of funds persists ... Russia may soon approach the threshold beyond which its missiles and nuclear systems become uncontrollable."

Then there are the military personnel in charge of the missile systems. One third of the Russian military are alcohol-dependent, and this is particularly prevalent with the officers. A survey of the US military in Italy and Germany found that 43% of *our* Army personnel were using drugs and 49% of the Navy. 28% of the Army personnel were found to be drinking while on duty and 21% of the Navy. And these are the hands that we have on the Big Red Switches.

Many of the Russian early warning radar systems are now in their former republics and are failing, making Russia partially blind. Two of their early-warning satellites have failed. This tends to make things much more dangerous, encouraging their overreaction.

Will we be able to survive the worsening missile crisis? Or the volcano crisis? The pole shift crisis? Etc. Tune in next year and I'll let you know. Hey, by then I'll have a few more even *worse* crises to worry you about.

Volcanoes

A recent report on the Art Bell show from Mexico City by a volcano expert said that their nearby volcano, Popocatepetl, which is 17,887 feet high and has a crater almost a half mile across, and was thought to be dormant, has been getting more and more active, but that its vents have been clogged so that it seems to be building up to a major explosion. The expert said he believed this could turn out to be the biggest volcano explosion in history.

If the volcano does let loose it could wipe out a big chunk of Mexico and blacken the atmosphere over the whole world, bringing on a sudden winter and stopping crops from growing for who knows how long.

Well, I thought you might not have enough to worry about.

Mexico has one other export of interest — smoke from a thousand or so of the field and forest fires that are raging out of control is rolling into Texas and other parts of our Southwest. The burning pesticides from the affected Mexican farm fields are now being reported to be making thousands of Texans sick.

The activation of Popocatepetl fits the pattern of awakening volcanoes around the world. There's the volcano on Montserrat, which has been dormant for centuries, Mt. Etna in Italy, and so on. Hundreds of volcanoes are newly active under the Pacific Ocean, and Mt. Fuji in Japan is starting to be active and has melted the snow from its peak for the first time since 1728. Two big volcanoes are newly active in Indonesia.

How come?

Well, I have a theory. The *El Niño* warming of the Pacific has increased the moisture in the atmosphere. This has brought heavy rains to the West Coast and tornadoes to the rest of the country. It's also increased the snowfall on Antarctica substantially. This, in turn, since that continent is off center from the South Pole, has induced some wobble which has been jostling the tectonic plates, reactivating old volcanoes.

Are the prophets right that the Earth's crust can actually slip, moving the poles? Nostradamus has predicted that this is exactly what is going to happen, and soon! René, Graham Hancock, Richard Noone, and Chet Snow, in their books, are all predicting essentially the same thing.

I've reviewed all of the books I have been able to find on the Millennium Catastrophes and put the information and my views into a new $5 book on the subject, complete with some ideas on how you and your family may be able to survive. If any of these prophets are right, and many of them have a history of accurate prophecy, the least you can do is make sure that you have a 12-volt ham rig available and maybe some solar cells to recharge it once the power grid is down and there's no more gas for generators.

Of course, if you're living in a city, never mind — just tell yourself that old crazy Wayne is at it again. But, say, have I ever been wrong in my editorial predictions?

Con Job

A letter from a Massachusetts reader pushed me to write again, harping on the same subject. Allen says: "I'm 24 years old and I run a part-time mail order business. I spent a year at Rensselaer Polytechnic Institute (RPI) and for $24,000 I can't remember one thing that I learned there, except that it was a waste of my time and money. My friends are urging me to give this business up and return to school, but I see no point in doing so. Reading your book *Making Money* has given me a lot of encouragement for my decision. I'm enjoying it and your sales video immensely."

Virtually all of us have been suckered into the idea that if we're going to amount to anything we really *must* go to college. My father believed it. I believed it. All of my school friends believed it. I don't recall ever seeing anyone write or talk about any serious alternatives to college.

My father got aced out of college by World War I and went to New York Military Academy, then into the Army Flying Corps. But he was so convinced of the importance of college that he always felt uncomfortable about not having gone to college. So, when I got out of high school it never occurred to me to do anything but go on to college. My dad paid for the first two years. Then World War II came along and I spent four years in the Navy and Uncle Sam paid for my next two years of college. I think it was PL-15, the program for disabled vets.

It never occurred to my dad that not one employer he ever had cared anything about his lack of a college degree. When Philadelphia needed an airport they came to him. He designed, built and operated Central Airport. Then he left there to be the passenger manager for Luddington Airlines (Amelia Earhart was a half-owner), the precursor of Eastern Air Transport (EAT), which became Eastern Airlines.

When Luddington sold out to Eastern he got American Export Steamship Lines, the largest American shipping line, to invest in the first trans-Atlantic airline, American Export Airlines. They started just before World War II and operated all through the war, flying from New York to London.

When the head of Pan-American Airlines convinced President Roosevelt to issue a presidential order making it illegal for a steamship line to own an airline, American Export was forced to sell the airline and it ended up owned by Pan-American.

Ooops, I got off on a tangent. Golly, that hardly ever happens, right?

Yes, a college degree is important if a person is going to work for a large corporation, for the government, or to teach. But, think about it, all three of these career paths have one thing in common: 99.999% of the people pursuing them are never going to make much money or to have much freedom. These jobs are for suckers.

Money and freedom are

mainly possible for entrepreneurs, and college has virtually nothing to offer as far as an education which will be of the slightest benefit when it comes to starting and owning your own business. My book *Making Money, A Beginner's Guide* explains how anyone of almost any age can learn the entrepreneurial ropes with someone else happily paying for their education.

College is a wonderful way to blow about $100,000 and four of the best years of your life. What a bargain. Better yet, this will set you up so that you'll never make much money or have a lot of freedom until you retire and are too old to enjoy it.

Am I exaggerating? I sure wish I was. Well, it's probably too late for you to benefit from what I've learned, but maybe your children or grandchildren can get off the well-beaten path to nowhere with a little shove from you. Actually, anyone from 17 to 70 can get off the track and learn entrepreneuring, but that requires the guts to make the change, and one thing that our schools have done very well is make most of us gutless. Few people have the determination to change, or the perseverance to stick by their decision.

A few years ago I tried to get RPI to change and put in some entrepreneurial courses. As a member of the RPI Council I got the Council to endorse the idea and pressure the faculty and president of the school to start providing entrepreneurial courses. The RPI president solved that problem by dissolving the Council and nothing changed. As a member of the Board of Overseers of the RPI School of Management I got the dean of the school to try and put in some entrepreneurial courses. The president got rid of him and dissolved the Board of Overseers.

I tried hiring some of the RPI School of Management graduates, but they were so out of their element in an entrepreneurial company that I finally had to give up on ever getting them to learn.

Oh yes, at one RPI Council meeting I explained to the group how wasteful it was for me to have endless classes where we had to memorize stuff for tests. Little of all that ever lasted in my memory. You have to *use* information to keep it available. Then the president of the Student Council got up and told the group that as far as he could see, nothing had changed in the 50 years since I'd been there.

I'm probably preaching to readers who have mostly been made deaf and blind by the hypnosis induced by our culture. Sigh.

Recycling PCs

There are tons of old PCs and printers out there available at scrap prices. Has anyone figured out anything to do with 'em yet?

The PCs are made up of a floppy drive, a monitor, power supply, keyboard, and the computer board. Most of the old PCs were taken out of service when just one of their elements failed, so by putting the working parts of two or three computers together you should be able to at least provide one working system, even though it may be using an older 386 or 486 chip.

Sure, these are slower, but they'll make very adequate and inexpensive word processors, and can be adapted for any number of applications.

A school or other nonprofit organization could attract an endless supply of these old machines from company storage rooms if the companies could get tax credits for their donations. That's a whole lot better for them than their dumpsters.

How difficult is it to update the old motherboards with newer chips? Or perhaps make a new board which could be patched in to update old systems? Hardware hackers should get their ingenuity working and get us some articles. There are millions of old PCs out there, so let's see what we can come up with.

Just look at what happened when the FCC forced taxicab companies to change to narrowband FM systems. We hams bought up their old rigs for pennies on the dollar and that started our repeater revolution. That's why our first repeaters were spaced 60 kHz apart. Of course it didn't take long before we had so many repeaters that we had to go to narrowband, spacing them 30 kHz apart. Then to our present 15 and 20 kHz. But it was those tons of old GE and Motorola taxi radio systems that triggered our revolution.

Don't just sit there — get your brain working!

Advertising Basics

If you're in business you have to advertise. If you're *not* in business, what's the matter with you? Are you so gutless that you're going to be a wage slave all your life? Yep, that's insulting, but how else can I get your attention if you don't have your own business yet? The Civil War obviously did not free all of the slaves.

One of the first things I discovered when I started my first major business was that none of the ad agencies I could find knew beans about my kind of product (a loudspeaker). That meant that I had to write my own ads. Believe me, seeing millions of ads during your life no more equips you to write ads than driving a car equips you to design an engine. I found myself in a whole new world.

OK, I decided, if I couldn't find competent help, I would have to learn the ropes myself. So I enrolled in a course in advertising put on by the Advertising Club of New York. And that was one of the best moves I've ever made. Priceless.

For instance, I learned that even some subtle differences in ads can make a whopping difference in their effectiveness. A small change in an ad can double or triple the resulting sales.

Now, let's look at ads aiming to sell ham products from the advertiser's point of view. Remember that your potential customer is most probably in his 50s–70s, so don't get swept away with gorgeous New Age yuppie graphics. Keep artists the heck away from your ad design. Also, no matter how tempting, keep engineers away too. They're going to start loading your ad with the amazing features your product has.

But let's start on an even more fundamental level — the style of type you'll use. Artists are in love with sans-serif type. Any book on type readability will tell you that serif type beats sans-serif around five to one. Since sans-serif type is more difficult to read, many people just won't bother. Worse, the more difficult type is to read, the less retention there is of your message. Serifs? These are those little platforms on the letters. This is sans-serif type. Avoid it like the plague.

If you really want to make an ad almost completely unreadable, use white type on a black background. This is called reverse type and artists love it. It's beautiful and eye-grabbing. There's a slight drawback, though — almost no one will bother to read it.

Then there's the increasing use of ragged-right lines of type vs. justified. If you don't mind cutting your readership in half, use ragged-right copy.

And this makes sense, if you stop and think about it. We learn to read books, magazines and newspapers where the columns of type are justified, so that's what our eyes are used to. Anything else slows us down. Ragged-left type will lose about seven times as many readers.

Oh, yes, this also applies to club newsletters.

One more piece of the advertising puzzle before I wind up class for today. This has to do with your headline. Copywriters have a simple rule: It usually takes as long to come up with a good solid headline as it does to write the rest of the ad. The headline has to be a grabber. When people are reading a magazine or newspaper they are not usually

doing so mainly to read the ads, so your headline will get a quick glance, and that's about it. You have just that fraction of a second to grab the reader's attention and get him to read further.

It's expensive to advertise, so you want every ad to do the maximum amount of selling possible. Anything less and you are throwing away sales and money.

Class will reconvene again if I get some encouragement from you. Then we can discuss what copy to write — and what *not* to write. I can explain how you can decide how big an ad to run, and how to find out what the best publications are for you to use to reach your target customers.

Mooned

As I mentioned earlier, Sherry recently signed up for a video production class at nearby Keene State College. The course naturally entailed her having to produce a short video. Instead of doing one on how to wash your socks or something like that, she decided to tackle the NASA Moon landing controversy.

She got every photo, video, and book she could find about the Apollo Moon missions. She read René's book, *NASA Mooned America;* Bill Kaysing's book, *We Never Went to the Moon;* and Bill Brian's *Moongate*. She read the autobiographies of the astronauts. I helped her by going through the three Moon books and making a list of the biggest reasons it looks as if the missions had to have been faked.

Sherry did a nice job of exposing some of the more obvious fakery in her "Moongate" short — which got her an A for the course. But this got me busy writing about the 25 main reasons I'm convinced NASA had to have faked the whole show. The result is a 20-page booklet which I have seriously overpriced at $5. It's called *Moondoggle*. If you want to be outrageous and really upset the believers, read the booklet.

Yes, I know, the whole idea that something as important to our country as our Moon landings could have all been faked is so ridiculous that almost anyone's first reaction is that you are crazy to even suggest such a thing. I don't believe this will turn out to be the biggest government hoax of the century, but it sure will at least be the *second* biggest. You'll get many times your five dollars worth of fun when you arm yourself with the information in this booklet. You may even want to get some extra copies to send to friends.

Catastrastroke!

After listening to one Art Bell guest after another predicting humankind's near-mass extinction in the near future, and then reading their books on the subject, I decided it was about time to put these millennial disaster prophecies into one master doom book. I've reviewed a bunch of the doomsday books for you in a new 28-page booklet. The worst part is that several of the prophets making the predictions have an impressive history of accurately predicting events such as earthquakes, volcano eruptions, and major weather changes.

I had a tough time deciding on a title for the book. Apocalypse, Armageddon, millennium catastrophes, disasters, and millennium holocaust scenarios all seemed on target. I finally decided on *Human Extinction Prophecies*.

It was difficult to stop writing because there are more and more millennium doom scenario books being published, keeping me busy buying more books and reading.

My review of our almost certain soon-to-be doom is $5. This will help me buy the new doom books as they come out.

I've covered many of the doom scenarios in my editorials, but this will have them all in one place for you, and without the usual editorial gerrymandering through the magazine. Or the minuscule type.

Yes, of course I offer some advice on how you and your family can at least have a good chance of surviving whatever is coming. Ed Dames, the remote viewing guru, has moved to a South Seas island. Gordon-Michael Scallion K1BWC has a farm not far from mine up here in the mountains of New Hampshire.

Editorial Reprint

My editorials from the May, June, July, and August 1998 issues are now available in a readable-type, un-gerrymandered edition for a semi-paltry $5. I've blown the dust off and gathered my 1997 editorials into three books, each covering a third of the year. And now there are two books for 1998, covering the first two thirds of this year. Each of these books runs around 80-100 pages, which is about as large a book as I can comfortably handle with my system. Each is $5. The 1997 collection totals 320 pages and is $15 for the set.

Smoke

The next time you see a kid smoking you might try passing along the news that a recent study found that 50% of the men over 40 who smoke are impotent and 30% suffer also from a hearing loss.

Ozone

I check in with René every now and then to see how he's doing. Recently he spent some hospital time. It seems that he didn't know that breathing ozone can make you sick. He sure knows now. René's the chap who wrote the NASA and Skeptic books I've been touting and you have avoided buying. Tsk.

On the ozone topic, a reader mentioned that Bob Beck has been promoting ozonated water for health. Some outfit is selling a gadget to make ozonated water for $400. It seems to me that one of you out there should be able to come up with a water ozonater that we can make for a few bucks. Any volunteers? Also, what's a good book on using the stuff?

While I'm on health, I've been getting some nice letters from Bioelectrifier users claiming it's been stopping cancer. But I'm still of the opinion that if you give your body the right nutrients and stop poisoning it, you'll be able to recover from almost anything. The details are in my *Secret Guide to Health*. The Bioelectrifier can, I believe, speed up the repair of your immune system from all the damage you've done to it.

New Hampshire

They had a show on PBS recently about New Hampshire's grand hotels. It sure brought back memories. My home town of Bethlehem had 30 hotels and 100 rooming houses, and some of the hotels were huge. The heyday of the big hotels was back in the 1920s, when people came up from New York and Boston by train and the hotels were packed solid all summer. Bethlehem, perched high up on the side of Mt. Agassiz, was particularly prized for its low pollen count, making it an excellent refuge for hay fever sufferers.

The depression of the 1930s hurt business badly, with many of the hotels falling into disrepair. It picked up a little after the war, in the late 1940s, but by the 1950s air travel made it possible for people to vacation anywhere in the country, and by the 1960s anywhere in Europe. Most of the old hotels eventually had to be burned for the insurance, so there aren't many of them left.

In the '30s roadside cabins sprang up all around the state, providing a lower-budget way to travel. Now it's motels, but there are still a few of the old cabins left.

New Hampshire is a beautiful state to visit, with plenty of interesting things to see and do. You really ought to get up here and see why the state always wins the top place on magazine surveys for its quality of life. A recent

report put Manchester as the best place in the Northeast for living, with two other of our cities in the top ten.

But more important are the scenic attractions, which are mostly in the White Mountains. There's the highest mountain in New England, Mount Washington. You can drive up on the carriage road or, better, take the old steam-powered cog railway. If you've the stamina you can climb it. I haven't climbed it lately, but it's a fun and challenging climb.

Just south of Mt. Washington is North Conway, where you'll find some fantastic factory outlet stores, plus have a chance to ride on an old steam train. Don't miss it!

Then there's Cannon Mountain, where you can take the first aerial tramway in North America to the top, snapping pictures as you go. I still have some slides I took when it opened in 1938. This is the mountain with The Great Stone Face on it, the "Old Man of the Mountains." You'll also get some great photos from the top of the mountain.

Just down the road a few miles is the Old Man's Foot Basin, which is a round pool worn in the rocks by the Pemigewasset River. You'll get a bunch of great photos in this area.

Then you'll come to The Flume, which'll use up a couple more rolls of film.

A few miles from there is Lost River Caverns, where you can climb through caves. This is a particular delight for kids.

When you're passing through the southern end of the state don't forget to give me a call. If I've time maybe we can meet in Hillsboro for a fabulous Chinese buffet lunch. Your treat. Mmmm, and it's only $5! You should see the 400-pounders waddling into the place. And you don't have to use chopsticks if you don't want.

Around the first week of October we put on a legendary fall foliage show. The colors have to be seen to be believed. There's only one other area of the world that has colors like these, and that's in northern China.

How about it?

If your hamfest chairman is too cheap to pay my fare to your hamfest for me to talk, come on up here, armed with questions. I love to talk.

Prisoners

Just as it is almost impossible for most scientists to accept anything that's different from what they were taught in school, and what they've thus probably been teaching, so the rest of us are prisoners of what we've been taught and believe, plus that which we can see with our own eyes. But we're also prisoners of our language, which, if it doesn't have the words to express new concepts, keeps us from thinking about them.

For instance, English is particularly bad when it comes to expressing feelings.

Anyone discussing death is up against all of these barriers. Anyone wanting to understand death better must somehow manage to surmount these barriers, which most of us don't even realize are there.

We have plenty of hints. No, let's make that data. We have endless reports of young children talking about their previous lives. Anyone can be regressed to previous lives under hypnosis and experience them with a great deal of reality. I've done that personally with over a hundred subjects. We have some excellently researched reports of communications with the dead. We call them "the departed." Psychics are able to part the veil and communicate with the dead. We have several groups around the world communicating with the dead via tape recordings. We have endless reports from people who have had near death experiences (NDEs) and others who've had out of body experiences (OBEs), neither of which are honestly explainable by "science."

We talk of "life" after death. We talk of "the next world." We talk of "different vibrations." And of "heaven and hell." We talk of spirit guides and angels. We talk of God.

We have other hints of things which may or may not tie in with the "afterlife" — like telepathy, clairvoyance, psychokinesis, and precognition — all of which have been scientifically proven far beyond any reasonable doubt. Of course no amount of scientific evidence fazes pathological skeptics, whose beliefs hold them prisoners.

We are such firmly held prisoners of our time dimension that the whole idea that our spirits can travel anywhere and anywhen in time is ungraspable.

When we have an NDE and are met by our "passed over" relatives and friends, we have the idea that they've been waiting around for us.

We have plenty of hints that our spirits are eternal, whatever that is. That we reincarnate every so often to learn things. I like the concept, but I'm afraid I don't believe it. We have been around for hundreds of thousands of years and I see no signs that we have learned anything from previous incarnations. People, in all, are just as lousy today as people were thousands of years ago. Tell me about the Hutus or Tutsis having learned from previous incarnations. Or the Arab fundamentalists. We are just ending the bloodiest century in the history of man.

I like the first line of P.J. O'Rourke's book, *Republican Party Reptile*, "Man developed in Africa. He has not continued to do so there."

Elsewhere we've developed some great technologies and arts, but psychologically we haven't changed much from as far back as our histories go. Will we ever grow spiritually? Or are we doomed to continue repeating our behavior endlessly, or at least until our apparently unlimited supply of bad guys destroys the planet? We now have the technology to destroy it, and a history of never having failed to use the latest technology for war.

We hams have our own proof of the lack of spiritual development of man on 14,313, and on a few of the 75 meter nets.

If we are returning to Earth to learn lessons, this Earthly school seems to be as much of a failure as our American school system.

LETTERS

continued from page 8

14.057 MHz, which put it near the center of my transceiver's frequency capability. The SWR continued to be 1:1! Finally, after starting a half-hour late, I began answering stations calling CQ-FD. The results were fantastic! By midnight, I had made contacts in 26 states, both East and West Coasts, plus many states to the north, and two Canadian stations in Ontario (VE3SPC) and British Colombia (VE7RAR). The number of contacts was actually 59. Although there was some fading on 20 meters, the band never quite closed, and I heard a couple of European stations working American stations. I am sure that if I had been running 100 watts or more, I could have made many more contacts, but the fun was in working half the United States with a peanut whistle! The Half-Square DX Antenna should do a great job for you too. It had less noise pickup than other antennas I have tried, and I am looking forward to building more gain wire antennas.

Harold Adams N2TLT. I really enjoyed you on the radio with Art Bell W6OBB. I also enjoy *73 Magazine* very much. Ham radio is a great hobby. The problem is that too many people are not open-minded. They won't buy your great magazine because you have different views and ideas. That difference is what makes you great! An open mind is a beautiful thing.

Continued on page 87

PROPAGATION

Jim Gray W1XU/7
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

August 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G	3 G-F	4 F	5 F-G	6 G-F	7 F	8 F-G
9 G	10 G-F	11 F	12 F-G	13 G	14 G	15 G
16 G	17 G	18 G	19 G-F	20 F-P	21 P	22 P-F
23 F-G	24 G	25 G-F	26 F	27 F-P	28 F-P	29 P-VP
30 VP	31 P					

At last! As I write in mid-May, solar flux values have reached the low 100s and hovered there for the past several weeks. WWV's "Solar-terrestrial Indices" are now using the term "moderate" instead of "low" or "very low" to describe the sun's activity. Whoopee! The HF bands have lots of DX signals on them, and it appears that the 10.7 cm solar flux has begun its long-expected rise toward the peak of Cycle 23, expected in 2001 or 2002.

Band-by-band propagation this month:

10–12 meters

Poor to Fair DX conditions on north-south paths during local afternoon, with occasional daylight sporadic-E short skip out to a thousand miles at times of intense ionization.

15–17 meters

Fairly good DX openings to the southern hemisphere during daylight hours. Occasional east-west openings to Europe and Africa during local afternoon hours, with sporadic-E short-skip openings between 750–1300 miles during times of intense ionization.

20 meters

The best band for worldwide propagation from shortly after local sunrise until well after local sunset. Peak conditions should exist during early morning and late afternoon or early evening hours. Short skip should prevail beyond 500 miles during the daytime.

30–40 meters

Good DX openings during the evening and night, and at sunrise. Peak conditions to the east should occur at around local midnight, and to other directions just before sunrise. Remember that thunderstorms will limit DO activity due to their covering up weak DO signals with atmospheric noise (static, QRN). Short skip to 1000 miles during the day and 2000 miles at night will prevail on most days.

80–160 meters

Little if any daytime signals will be heard due to high absorption levels on these bands. However, some DX may be possible (limited by thunderstorm activity) around the predawn hours to some areas of the world. Short skip during the day to about 250 miles and during the night to about 2000 miles will be common, except as hindered by QRN.

Make sure your antenna systems are well grounded during these summer thunderstorms, and be certain that your station equipment is lightning-protected. Plan your DX operations with the accompanying calendar: G Good; P Poor; F Fair; VP Very Poor; G-F Good to Fair, etc. W1XU.

Note about chart: The indicated band is only a guide. Always check the next higher or lower band. Where 10 meters is shown, listen on 12; where 15 meters is indicated, listen on 12 and 17; and so forth.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA							20					
ARGENTINA	20	20	20	40	40						10	15
AUSTRALIA				20	20	40	20	20				
CANAL ZONE	15	20	20				20	20	20		10	15
ENGLAND	20		40/80	40/80						20	20	20
HAWAII	15	20	20	20	40	40						15
INDIA	20	20										
JAPAN							20					
MEXICO	15	20	20				20	20	20		10	15
PHILIPPINES							20					
PUERTO RICO	15	20	20				20	20	20		10	15
RUSSIA (C.I.S.)	20	20/40	20/40								20	20
SOUTH AFRICA		40	40	20	20						20	20
WEST COAST	40	80						20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA			20			40		20				
ARGENTINA	20/40	20/40	20	40				15	15	15	15/20	20
AUSTRALIA	15	15	15/20	20	20	40	20	20			15	15
CANAL ZONE	20	20	20	40	40		20	20	15/20	15	10	10
ENGLAND	20		40	40			20	20			20	20
HAWAII	15	15	20	20	20	40	20	20				15
INDIA	20	20					20	20				
JAPAN			20			40		20				
MEXICO	20	20	20	40	40		20	20	15/20	15	10	10
PHILIPPINES							20	20				
PUERTO RICO	20	20	20				20	20	15/20	15	10	10
RUSSIA (C.I.S.)							20	20				
SOUTH AFRICA			40	20	20							

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA				20	20	20	40	20	20			
ARGENTINA	15	20	20	20				20				15
AUSTRALIA	15	15	15	20	20	20/40	40	20/40				
CANAL ZONE	10	15	20	20	40	40		20	20		15	10
ENGLAND	20	20	20					20				20
HAWAII	15	15	15/20	20	20	20/40	40/80		20		15	15
INDIA			20	20				20	20			
JAPAN				20	20	20	40	20	20			
MEXICO	10	15	20	20	40	40		20	20		15	10
PHILIPPINES				20	20			20	20			
PUERTO RICO	10	15	20	20	40	40		20	20		15	10
RUSSIA (C.I.S.)	20	20	20					20				
SOUTH AFRICA				20	20							
EAST COAST	40	80						20	20	20	15	40

LETTERS

continued from page 86

Well, open, but not drafty. Harold, it's a tough uphill fight. Our schools, our culture, our media, our peers and even our parents have so befogged our minds with lies that getting the truth out is a major undertaking. We believe in our schools, doctors, jobs, and even our government. Hey, many hams even believe in the ARRL! ... Wayne

Number 88 on your Feedback card

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, Include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the November 1998 classified ad section is September 10, 1998.

ASTRON power supply, brand-new w/warranty, RS20M $99, RS35M $145, RS50M $209, RS70M $249, **AVT**. Call for other models. **(626) 286-0118.** BNB411

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925-5899. 8–4 ET. BNB964

POWER TUBES FOR SALE: Sell or Trade. ARS Electronics **(818) 997-6279**. P.O. Box 7232, Van Nuys CA 91409. BNB13

COLLOIDAL SILVER GENERATOR! Why buy a "box of batteries" for hundreds of dollars? Current regulated, AC powered, fully assembled with #12 AWG silver electrodes, $74.50. Same, but DC powered, $54.50. Add $2.50 shipping. **Thomas Miller**, 314 South 9th Street, Richmond IN 47374. BNB342

WANTED: High capacity 12 volt solar panels for repeater. [**kk4ww@fairs.org**] or (540) 763-2321. BNB2630

MAHLON LOOMIS, INVENTOR OF RADIO, by Thomas Appleby (copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM** N3RF, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

QSL CARDS. Basic Styles; Black and White and Color Picture Cards; Custom Printed. Send 2 stamps for samples and literature. **RAUM'S**, 8617 Orchard **Rd.**, Coopersburg PA 18036. Phone or FAX (215) 679-7238. BNB519

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com]. BNB113

BIOELECTRIFIER™ 5 Hz micro current supply for plant and animal research. Semi-Kit $38.00. Assembled complete with batteries and silver electrodes $89.50. Add $2.50 postage. **Thomas Miller**, 314 South 9th Street, Richmond IN 47374. BNB343

METHOD TO LEARN MORSE CODE FAST AND WITHOUT HANGUPS Johan N3RF. Send $1.00 & SASE. SVANHOLM **RE**SEARCH LABORATORIES, P.O. Box 81, Washington DC 20044 USA. BNB421

1991 WORLD SERIES, Twins vs. Braves, "Most Exciting World Series Ever!" Official MLB 80 minute VHS color video captures 7 games of thrills. $22.95 plus $3 s/h, while supply lasts. Radio Bookshop, 70 **Rte.** 202N, Peterborough NH 03458; Tel. **1-800-274-7373**; FAX (603) 924-8613. MC, Visa, Amex, ck., m.o. BNB60

FREE: Scanner collector's methods and secrets. Learn how to buy, sell, trade and USE scanners in the most efficient manner. Enclose $2.00 for postage and handling to: P.O. Box 402, Decatur TX 76234. BNB523

RF TRANSISTORS TUBES 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, etc. **WESTGATE**, 1 (800) 213-4563. BNB6000

QRX

continued from page 79

aviation communications at Sacramento Executive Airport in northern California.

Airport officials had complained to the FAA that several communications channels were receiving interference from a radio station that appeared to be drifting or changing frequency. Pilots flying over the area had also reported hearing a radio station over the air traffic control radio channel.

The investigation led to an unlicensed station operating on 107.2 MHz. Its location was the office of Dollar and Sense Productions in a south Sacramento office.

This incident marks the fourth time in the last five months that the FCC had to locate and remove illegal radio stations from the airwaves for interfering with air traffic control communications.

From *Newsline* #1077, adapted from *CGC Communicator.*

73 Amateur Radio Today

SEPTEMBER 1998
ISSUE #456
USA $3.95
CANADA $4.95

International Edition

Rebecca Rich KBØVVT

The Incredible Lazy Loop

Build A Crystal Radio

Dogleg 10–40m Wire Vertical

Review:
Repeater Controller Kit

LETTERS

Number 6 on your Feedback card

From the Ham Shack

Kirk Ellis KK4YP, Massillon OH. I really enjoy reading *73*. Liked reading "Techno-Trouble II" in the June issue. However. Mr. Katz was mistaken on one of his geography questions and answers (# 25). Being a native North Carolinian. I would like to point out that there are a number of mountains. in both North Carolina and Tennessee. higher than Mt. Washington. New Hampshire, which is not the highest point east of the Mississippi River.

That honor goes to Mount Mitchell. NC. at 6684 feet above sea level (named for an explorer who fell to his death trying to prove it the highest mountain in the eastern US), versus 6288 feet for Mt. Washington.

Also, a few others higher than Mount Washington: Clingman's Dome. Tennessee, at 6643 feet; Mt. Guyout, also in Tennessee, at 6621 feet; Mt. Le Conte, Tennessee, at 6593 feet, and Richard Balsam Mountain, in North Carolina, at 6540 feet. Mt. Mitchell has a state park at the top and offers a great place to work DX and contests, especially on six meters and above!

Thanks for a great magazine — it keeps me thinking. I really look forward to receiving it each month — and don't change your editorials. I have ordered many of the books you recommended. I am an engineer with a PCS cell phone company and also run two of my own part-time businesses (RF consultant and test equipment sales), which I hope will one day become full-time.

Your editorials have made me think, and made me decide it's time to broaden my knowledge of things other than just ham radio and electronics, where I have been spending a lot of my time reading and studying for the past 20 years.

The mind is like a muscle – you either use it or lose it ... Wayne.

Dick Clark K6GLB, Gig Harbor WA. I have neither heard nor read of you since my subscription to *CD Review* expired. I admit I miss your commentary, because, on so many topics, I found myself in agreement with your philosophy. Not only that, I have tremendous admiration for those who had the courage to volunteer in the Silent Service and who contributed in such a great way to defeating the Japanese by sinking over 55% of their shipping.

I was fascinated by your comments about our voyages to the Moon. Like Art Bell W6OBB, I am skeptical of your analysis, but your facts are indeed interesting. I certainly hope you are wrong; however, you are one of the few people who have the credibility to draw serious attention to this issue.

I earned my Novice license in 1953, and then Technician, and upgraded to General in the early '60s. Then the ARRL pushed "incentive licensing" down our throats and took away some of my hard-earned privileges. That was the end of my relationship with the ARRL—and I have agreed with every editorial you have written on that subject, including the code requirements for licensing. The ARRL is the best friend of the communications industries, who want to expand their usable range of frequencies at the hobby's expense. Unfortunately, because the hobby is dying and our only representative is contributing to its demise, industry will probably win a substantial chunk of band allocations. Twenty years from now, just how many hams will there be? They will probably be outnumbered by employees at the FCC.

Jerry Mulberg W2MJP, Riverdale NY. Keep up the good work on your timely "Never Say Die." It is most interesting and informative, besides being excellent on subjects other than ham radio. We all appreciate your excellent column about everyday living and breathing. We need more guys like you with your look to the future about so many aspects of everyday living.

Jerry, your letter came in the same mail as W3ZC's. [See last month.] Considering that most people only write to an editor when they have a beef, one thing that keeps me not just going, but happily going, is the number of letters like yours that the readers bother to write. Now that I'm not bogged down running seven magazines a month, or trying to cope with my chain of computer software stores, or with producing CDs, I've been spending most of my time looking for information that will help people to live better lives. Yesterday I ordered 38 books from Barnes & Noble which have been recommended by my readers and some experts I've come to respect. That's a lot of homework to do, and then to report on, but I don't know of any other magazine anywhere that provides such a wide variety of information ... Wayne.

Richard Donovan AC5OD & Robert Thompson KF3L. Three cheers for the ultimate old wheezer, our steely-eyed rattler of cages and square-jawed eater of tornadoes, Wayne Green. This cantankerous old curmudgeon, a true crotchety crustacean on crusade for truth and light in amateur radio, represents the true ham spirit with the blaring voice of a rusty foghorn.

While others parrot the party line, pretentiously lockstepping in their tiny-mindedness, our fearless leader, a true geezer among geezers, exposes these Lilliputians for what they are, that is, mindless and soulless robots whose main desire is to have control over everyone.

We will be safe from harm for as long as our hero treads the oceans and continents of this troubled planet, carefully sandpapering flat the faces of the stoneminded, self-proclaimed "Radio Elite." Our true hope is that somewhere within the increasing QRM, a budding diamond in the rough is ripening on the vine, ready to follow in his footsteps.

One day, our iconoclastic voice in the night will depart this earthly QTH, leaving us all poorer as a result. So keep on keeping on, Wayne, we're behind you. If you didn't exist, we would have had to invent you.

Aw, shucks. By the way, I eat tournedos (slices of beef), not tornadoes. I've been waiting for years for an heir (hair?) apparent to start sending me publishable editorials. My in basket flourisheth not with such ... Wayne.

James Long, Ph.D., P.E., Sunnyvale CA. The new analog wall clocks by ZEIT bring new meaning to the phrases "A day late and a dollar short" and "Hay is always cheaper after passing through the horse."

All the cutesy inconvenience features (that cannot be defeated by the user) that were condemned by a *QST* review of the digital-readout desk model have been carried over into the analog model.

The cumulative effects of gravity, dead zone, dial misalignment, and gear eccentricity produce plus or minus one minute error in the reading of the minute hand during different parts of the hour.

The clock is not continuously synchronized to an atomic standard as stated in the *QST* advertisement. It is a

Continued on page 62

QRX . . .

"Young Ham of the Year" Shares His Award with Children in Need

A 16-year-old from Florida has surprised the ham radio community by donating part of his award as *Newsline* "Young Ham of the Year" to the "Make A Wish" Foundation. Richard Paczkowski, Jr. KF4BIA, of Edgewater, Florida, says that he donated his week at Spacecamp Huntsville to the organization so that a less fortunate youngster can enjoy his or her dream:

"What I would like to do, if possible, would be to donate my week at Spacecamp to the 'Make a Wish' Foundation. As you know, children with life-threatening illnesses are signed up with the organization and 'Make a Wish' tries to make their wish come true," said Paczkowski.

"I am sure that there is a little kid, somewhere, who really wants to go to Spacecamp. It would give me a lot more joy to know that there is one little kid out there for whom going to Spacecamp is his great wish, and have it come true."

The week at Spacecamp is a part of the "Young Ham of the Year" Award, underwritten by *CQ Magazine*, of Hicksville, New York. *CQ's* Advertising Manager, Arnie Sposato N2IQO, says that he is very impressed by Richard's generosity.

"It's really such a nice gesture and very commendable on his part to make such an offer. It is a wonderful thing that Richard is doing," said Sposato.

Photo A. 16-year old Richard Paczkowski Jr. KF4BIA, 1998's "Young Ham of the Year."

Also delighted by Richard's generosity was Yaesu USA's Director of Sales and Marketing, Kevin Karamanos WD6DIH. Yaesu is another of the "Young Ham of the Year" Award corporate sponsors. Karamanos believes that Paczkowski has set a new standard for those who will follow.

"I should not be shocked because of the caliber of people who are selected to receive this award; it's only that I have never heard of anyone doing this, and it is such a great idea. It's just super!"

Richard Paczkowski Jr. was named the 1998 "Young Ham of the Year" based on his four-year amateur radio career, dedicated almost exclusively to public service work, including organizing local county communications support during the recent Florida wildfires.

In her letter nominating Richard for the award, Patricia White N6LKC/4, stated: "This young man deserves this award because of his outstanding dedication in serving his community at times of need and distress ... With his active and 'beyond the call of duty' attributes, he has successfully and honorably used amateur radio in the light with which it was meant to shine ... This fine young man is the representation of what amateur radio is all about and was meant to be."

Richard Paczkowski Jr.'s decision to donate his trip to Spacecamp to a seriously ill child more than reinforces Mrs. White's words. It shows him to be a young man of compassion for, and understanding of, the needs of those less fortunate. He will receive his award the evening of August 15th, 1998, at the Huntsville Hamfest in Huntsville, Alabama.

TNX Bill Pasternak WA6ITF, editor of *Amateur Radio Newsline.*

ARRL Proposes Simplified Licensing

The ARRL Board has agreed to propose a simplified Amateur Radio licensing structure with four classes. Lengthy discussion and debate during the board's meeting July 16–18 led to majority support for a plan for four written examination elements to establish amateurs' operational and technical qualifications instead of the present five, and two Morse code examination elements instead of the present three.

Under the plan adopted by the board, the entry level to amateur radio would be known as "Class D" and would convey the privileges of the present Technician license. The written examination would be at the same level of difficulty as that of the present Technician examination, and consistent with the privileges of the license. All amateurs now licensed as Technicians would become Class D.

The next step would be known as "Class C" and would convey the privileges of the present General license, but with phone subbands expanded by 50 kHz on 75 and 15 meters and by 25 kHz on 40 meters.

Class C would be the entry level to high frequency (HF) operating privileges. To upgrade from Class D to Class C, an amateur would pass a written examination on the operational and technical qualifications required for HF operation and a 5 WPM Morse code examination. All amateurs now licensed as General, Technician Plus, and Novice would become Class C. The expansion of the telephony subbands would result from "refarming" of the Novice CW bands that are no longer required for their original purpose.

The third step would be known as "Class B" and would convey the privileges of the present Advanced license, but with phone subbands expanded by 50 kHz on 75 and 15 meters and by 25 kHz on 40 meters. To upgrade from Class C to Class B, an amateur would pass a more advanced written examination, similar in difficulty to the present Element 4A and a 12 WPM Morse code examination. All amateurs now licensed as Advanced would become Class B.

The final step would be known as Class A and would convey the full privileges of the present amateur Extra Class, with telephony subbands expanded by 50 kHz on 75 and 15 meters and by 25 kHz on 40 meters. To upgrade from Class B to Class A, an amateur would be required to pass the most difficult written examination in the sequence. Consistent with the practice in many other countries, no additional Morse code examination would be required beyond 12 words per minute. All amateurs presently licensed as Extra Class would become Class A.

In their discussions, board members emphasized that the objective is to rationalize and simplify the amateur licensing structure without reducing the requirements for any class of license. Where reductions in Morse code requirements are proposed, there would be a corresponding increase in written examination standards. On the other hand, board members were adamant that simplifying the structure should not come at the expense of privileges already earned by amateurs. Therefore, present Novice and Technician Plus licensees, having earned entry-level HF operating privileges, would be granted the new entry-level HF license.

Adoption of the simplification plan marks the culmination of 30 months of work by the board, during which time the input of literally thousands of ARRL members and other amateurs and prospective amateurs was considered. The board debated a wide variety of options, including both smaller and larger numbers of license classes, higher and lower qualification levels, and different privileges. Nine of the 15 directors voted in favor of the plan, with six opposed. Following the

Continued on page 59

The Ultimate Green Radio

... great "Beginners' Night" project!

Dave Evison W7DE
153 Park Ave.
Palo Alto CA 94306
[w7de@aol.com]

What do you get when you mix two empty aluminum cans, a couple of empty toilet paper tubes, and a germanium diode? The Ultimate Green Radio!

Although the accompanying photo may raise a few eyebrows, this is no joke. The unique crystal radio described in this article really works! It's a little tricky to tune, but it is super selective and loud. And it has, of course, all the attributes of a crystal radio: It receives standard AM broadcasts, has no active components, and requires no power whatsoever! All it requires is a good antenna and a pair of high impedance headphones (2000 Ω or better). You'll be hard pressed to find any other electronic device as environmentally friendly, so I've named it The Ultimate Green Radio.

Another appealing attribute of this unique crystal radio is that virtually all the parts can be salvaged from waste artifacts found in the average home. The crystal radio described in this article was built completely from salvaged parts and common household items except for the germanium diode (12¢) and two Fahnestock clips (11¢ each).

The unique aspect of the UGR is its homemade aluminum can variable capacitors. Normally, air dielectric variable capacitors, with their elaborate meshing plates and ball bearing shafts, are used. Such variable capacitors are both expensive and difficult to find. I developed the aluminum can variable capacitors to solve the availability and cost problems. They replace $30 worth of the traditional air variable capacitors, at the cost of the deposit value of two empty aluminum cans—and provide a great example of recycling ancient

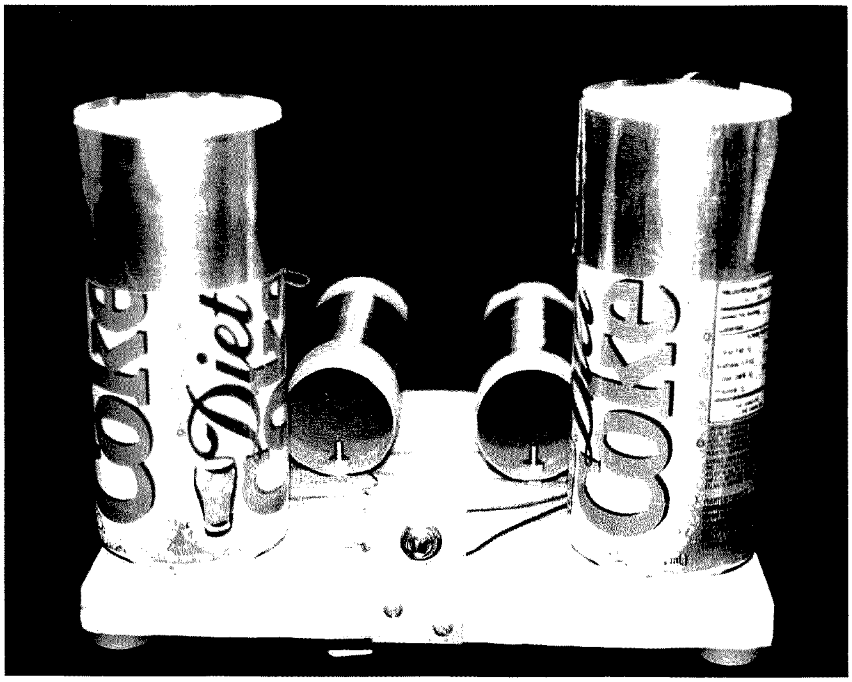


***Photo A.** Finished—and ready to start listening to the radio!*

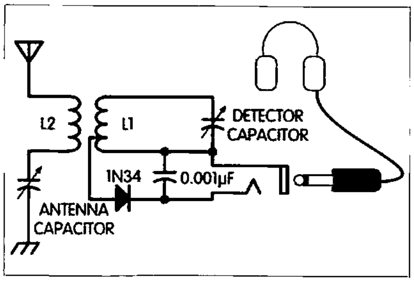


Fig. 1. Schematic for the Ultimate Green Radio.

technology: They're really a variable capacity version of the granddaddy of all capacitors, the Leyden jar (circa 1745).

The crystal radio is almost as old as radio itself. Although it may be basic ancient technology, the crystal radio has launched more engineering careers than any other single electronic project. I built my first crystal radio in 1942. It was my Aladdin's lamp—my first solo experience with science—and it launched my engineering career that spans over 40 years. Therefore, the UGR is an ideal project to share with a youngster—it's inexpensive, it involves no hazardous voltages, and it demonstrates many electronic principles (inductance, capacitance, resonance, detection, etc.). It also illustrates something very important to young minds: Complex modern technology is just the resourceful integration of basic concepts and components, incorporated into the simple crystal radio. And, of course, the UGR also demonstrates a direct approach to recycling.

About the circuit

The basic circuit (**Fig. 1**) used for the UGR was developed in the 1930s by Elmer G. Osterhoudt 6NW, a well-known ham operator and prolific inventor. The circuit incorporates an antenna tuner, inductive coupling between the antenna tuner and the detector tuned circuit, and a germanium diode tapped into the low (or cold) end of the detector coil to keep the headphones from swamping the tuned circuit. This design ensures optimum transfer of energy from the antenna system and produces very sharp selectivity.

Gathering materials

Bathroom wastebaskets generally contain one or more empty toilet paper tubes. The family recycling bin will likely produce a couple of empty aluminum beverage cans. A small piece of pine board can be salvaged from an old packing crate or from the trimmings pile at a local lumberyard. A couple of discarded overhead projector transparencies (view foils) can be plucked from your office wastebasket. Items such as magnet wire, germanium diode, 2000 Ω headphones, Fahnestock clips, solder lugs, etc., are probably lurking in your junk box (we hams are pioneers in recycling!). Whatever you're unable to scrounge, you can purchase at a local ham swap meet, Radio Shack™ or Antique Electronics™.

Winding the coils

Coil winding is a unique experience and can be quite frustrating if you do not have good vision and a steady hand. Allow yourself about 20 minutes to wind each coil. Once you begin winding, consider yourself committed to finishing the task. Find a time when you will not be interrupted. Begin by marking the toilet paper tubes (a/k/a coil forms) as depicted in **Fig. 2**. Make the mounting holes first, then make the small holes at either end to secure the wire by threading it through the holes at the beginning and end of the coil. When winding the wire around the tube, try not to overlap previous windings; keep them side by side and close together. Since the cardboard tubes are quite thin, be careful not to squash them while handling (however, keep the windings tight on the tube). Once wound, cellophane tape can be wound around the ends of the windings for a little extra security.

Dealing with the tap on the detector coil: The tap is formed by making a hairpin loop (about three-quarters of an inch tall), then twisting it together a couple of times. After the tap is formed, continue winding the rest of the coil. After the coil is completed, carefully scrape the enamel coating off the twisted tap, using a pocket knife or fine grit sandpaper. It is necessary to remove the enamel from the tap to expose the bare copper. This will allow you to solder a wire to the tap. Go easy with the scraping so that you do not cut through the wire—just remove the enamel coating. The enamel must also be removed from the ends of the coils so they can be soldered during assembly.

Producing the aluminum can variable capacitors

Select two undented, non-sticky aluminum cans. Inspect the transparencies: They must not be wrinkled or punctured. Cut the transparencies exactly five inches by 11 inches, and the aluminum foil tape exactly two inches by nine inches (use a paper cutter if you have access to one).

Carefully wrap the transparency tightly around the can, and be sure that any printing on the transparency faces

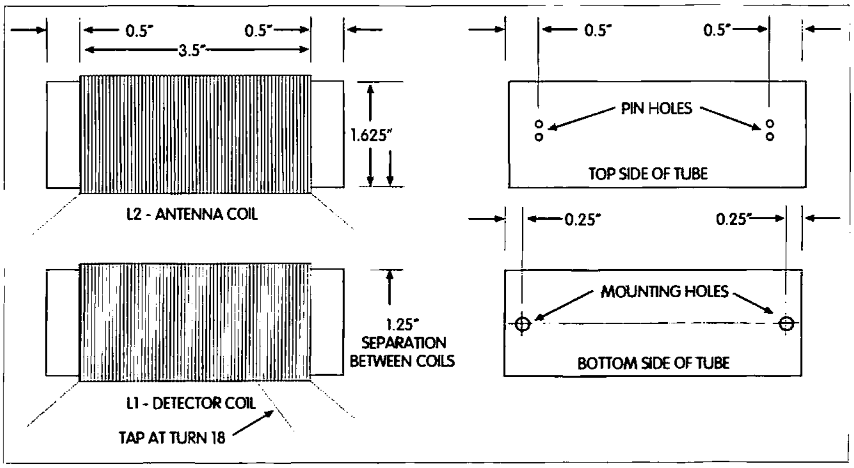


Fig. 2. Coil specifications for the Ultimate Green Radio.

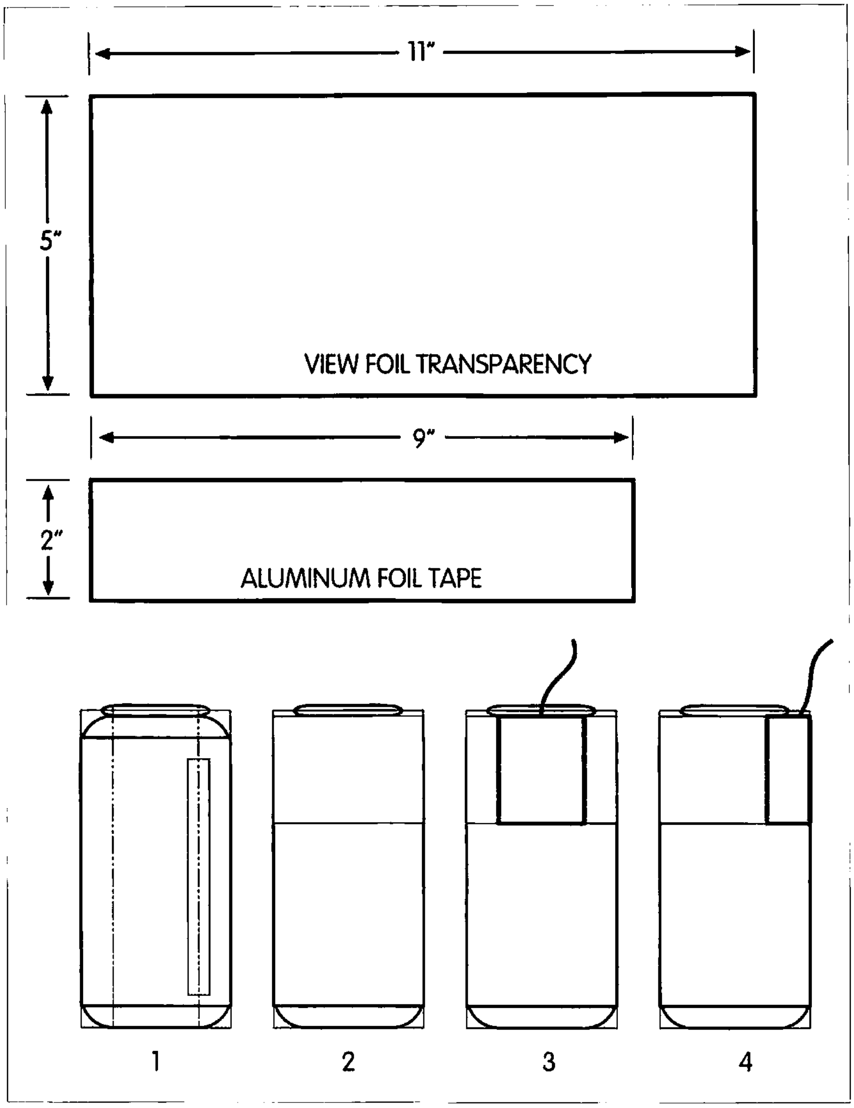


Fig. 3. Wrapping the transparency, making the desoldering-braid contact, and holding everything down with the aluminum tape.

outward. The transparency will overlap itself a couple of inches. Set the can upright on a flat surface, and while holding the transparency onto the can to keep it from unwinding, slide the wrapped transparency down until it touches the flat surface. Make sure that the bottom of the transparency is square and flush with the flat surface. Now, tape the wrapped transparency where it overlaps, using cellophane tape (**Fig. 3-1**).

I found it useful to apply the aluminum tape by temporarily placing the transparency sleeve onto a full unopened can (and you can return the unopened can to the refrigerator when you have finished). Before applying the aluminum tape, turn the can sideways, then slip the transparency sleeve down the can so the top three inches of the sleeve are below the shoulder of the can. Wrap the tape around the transparency sleeve so that the top of the aluminum tape is about one-quarter inch from the top of the transparency sleeve (**Fig. 3-2**). You are now ready to install the electrode for the aluminum tape.

Connecting to the aluminum foil

A piece of desoldering braid is used to make electrical contact with the aluminum foil. This contact will be completely frictional, so make sure that it is a good, tight physical contact. Prepare 12 inches of braid and attach it to the aluminum foil tape using another piece of aluminum tape (approximately three inches long) to hold it in place (**Figs. 3-3** and **3-4**). Now check to be sure that the completed transparency sleeve slides freely up and down on the can, but that it is tight enough so it will remain in position once it is set. Repeat the process for the second aluminum can variable capacitor.

Mounting the parts

The original UGR was built on a piece of lumber salvaged from an old packing case. It is nine inches wide, eight inches deep, and three-quarters of an inch thick. Any size board will work as long as it provides enough space for the aluminum can caps and two coils. The coils are mounted using 1-1/2 inch #6 x 32 bolts and nuts. All other parts are fastened using small screws, as shown in **Fig. 4**.

Parts List

Qty.	Description
L1, L2	115 turns each of #22 gauge enamel-covered magnet wire (RS# 278-1345)
2	empty aluminum beverage cans
2	overhead projector view foils (new or used)
22"	2"-wide aluminum foil tape
10"	3/4"-wide transparent cellophane tape
38"	desoldering braid (RS# 64-2090)
1	.001 µF fixed capacitor (RS# 272-126)
1	1/4" phone jack (RS# 274-252)
1	1N34 germanium diode (RS# 276-1123)
Pine board, 9" x 8" x 3/4" (approximately)	
Miscellaneous hardware; nuts, bolts, screws & solder lugs	

Table 1. *Parts list. For L1, a tap is placed at turn 18 of 115 turns of wire. The windings occupy 3-1/2 inches. For L2, 115 turns of wire are closely spaced and occupy 3-1/2 inches. A total of approximately 105 feet of wire is needed for the coils.*

Attaching the aluminum can variable capacitors to the board requires a little ingenuity. The aluminum cans are mounted by carefully punching a hole in the bottom of the can, then feeding a screw through the opening in the top of the can and into the hole. Before tightening the screw completely, place a seven-inch piece of desoldering braid beneath the can to make electrical contact with the bottom of the can (the braid should extend beyond both edges). The screw is then tightened into the wood to mount the can and to make good electrical connection between the bottom of the can and the desoldering braid (see **Fig. 4**).

Soldering

Solder lugs are cheap and readily available, and I recommend that you use them. When soldering the germanium diode (1N34), be careful not to get the diode any hotter than necessary. If possible, have someone grasp the lead of the diode (between the solder joint and the diode body) with a pair of long-nose pliers while the part is being soldered. This will draw the heat away from the diode and into the pliers. If you don't have anyone to assist you, wrap a rubber band around the handles of a pair of long-nose pliers (to keep the jaws closed), and then connect the pliers between the solder joint and the body of the diode. When soldering, be very careful that the soldering iron does not touch the transparency sleeves. It doesn't take very much heat to ruin them.

About headphones

There is really no substitute for a good pair of high impedance headphones (2000 Ω or greater). A good pair of headphones will last a lifetime. Ham flea markets are a good place to buy used headphones (but be sure they are at least 2000 Ω). New phones are available at Antique Electronics; call (800)-706-6789.

About antennas

The better the antenna, the better the crystal radio will work. This crystal radio functions entirely upon the very small voltages induced into the antenna by the signals transmitted by the radio stations. Make the antenna as high and long as you can. An antenna 100 or more feet long is recommended. You can hang the wire from trees, between houses, or from almost any available support. If you intend to use an amateur dipole with the UGR, keep in mind the following: If the antenna contains a balun, it will have to be bypassed. If it is fed directly with coax, tie the braid and center conductor together. For good reception, at least a 40-meter dipole fed with open line will be required. Remember, a half-wave antenna for the BC band is about 500 feet long!

For best performance a crystal radio should have a good earth ground. This can be accomplished by connecting the ground connection of the UGR to a pipe driven three or more feet into the ground, or to a nearby cold water pipe (assuming you have metal plumbing!).

Operating the Ultimate Green Radio

The UGR is a little tricky to tune. This is because:

- Both the antenna and detector tuned circuits must be tuned to the same frequency;
- The tuning process itself is skill-intensive (not unlike playing the trombone);
- Both the antenna and detector circuits tune very sharply. It just takes a little practice. Keep in mind that the aluminum can variable capacitors track very closely. For example, if a station is located near the high-frequency end of the band, both of the transparency sleeves will extend well above the top of the cans, and about the same amount. As stations lower in frequency are tuned, the sleeves will be proportionally lowered onto the can. The aluminum can variable capacitors are adjusted by grasping the transparency sleeves below the aluminum foil, and carefully and slowly moving them up or down.
- To help manage the friction between the can and the sleeve (thereby enhancing fine adjustment) slowly rotate the sleeves back and forth about an inch while moving them up and down.

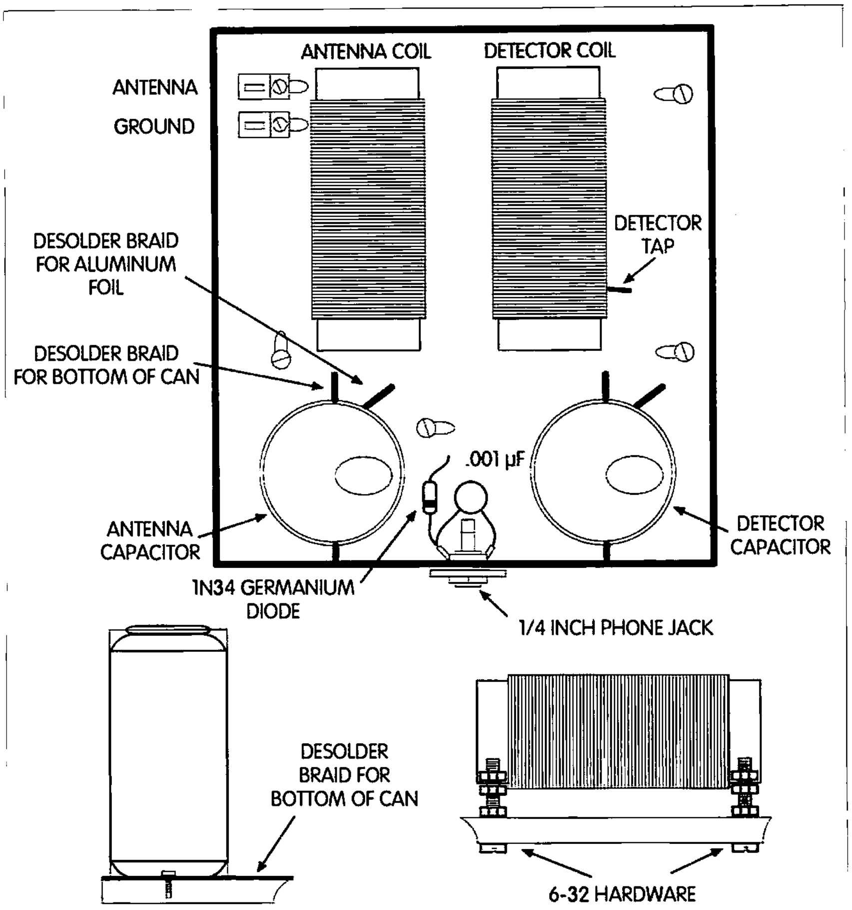


Fig. 4. *Parts identification, mounting, and wiring information.*

Unlike most radios, the UGR does not have dials for logging stations. However, you will be able to produce a log by using the printing on the can to index the position of the bottom of the foil. The Nutritional Facts label on the side of the can works well for this purpose.

Okay, let's try it. Attach the antenna and ground to the UGR. Connect the headphones and put them on. Place both transparency sleeves so that the bottoms of the aluminum tape are even with the shoulders of the cans. Now, carefully—and very slowly—move both of the transparency sleeves downward at the same time and at the same rate. In this way they will be roughly tuning to the same frequency as they move down the can. Once you hear a station, leave the antenna capacitor sleeve where it is and carefully tune the detector sleeve for the maximum volume. Once you have done this, carefully tune the antenna sleeve for maximum volume. You may have to jockey back and forth between the two capacitors until you get it just right. After you get a station tuned in, check the position of the bottom of the aluminum tape on the detector capacitor and log its position relative to the printing on Nutritional Facts label. Continue this process as you move the sleeves down the can. Once you have gained the tuning skills, it's a lot of fun to tune.

The Ultimate Green Radio, although a low-tech, low-budget project, illustrates a number of important concepts—especially from an environmental perspective. With our landfills overflowing, the ozone layer perforated, and our air and water polluted, the message is clear: We must learn to be less wasteful and careless, and try to find innovative ways to clean up our planet and keep it that way. The Ultimate Green Radio, with its straightforward display and utilization of waste artifacts, is an ideal instructional aid to stimulate creative recycling solutions—and might cause us to take another look at items we classify as "trash."

Another important message is that older technology is, in many cases, superior to modern technology in terms of simplicity, efficiency, and environmental impact. The simple crystal radio described in this article is constructed almost entirely of household waste, yet it is a fully functioning radio with wonderful fidelity and selectivity, and it operates at an efficiency unmatched by modern technology. And best of all, anyone can build one—even an eight-year-old (with a little loving guidance from grandpa).

Typical Antenna Installation

Try to get your antenna as high and long as possible, but keep it away from power lines. Nylon ties make excellent insulators; they are strong, light and inexpensive. You can use a the bungee cord to keep the antenna taut and prevent it from breaking during windy periods. While most wire sold as antenna wire is bare copper, #18 gauge stranded copper insulated wire is easier to work with and will last for years. The color of the insulation can be selected to make the wire nearly invisible.

An earth ground can be made by driving a metal rod or pipe at least three to four feet into the ground. The best way to accomplish this is to purchase a ground rod of the type used by electricians for grounding the electrical service, which are available at most well-stocked hardware stores. If your home is plumbed with metal pipe, a cold water pipe also can be used. The best way to make connection to the ground rod or cold water pipe is to use a ground clamp. They are readily available at hardware stores, too.

Number 16 on your Feedback card

What's the Scoop on the Lazy Loop?

Here's how multiband wire antennas measured up in real-world comparisons.

Ed Van Overloop WA2UGT
106 N. Fifth Street
Park Ridge NJ 07656-1024

Twenty years ago, I installed my first 80-meter full-wave horizontal loop antenna, called "The German Quad" by DF3TJ in his article (*73 Magazine*, June 1978). Since that time, I have continuously used this type of antenna as a standard of comparison for all other antennas used at my QTH. Although several construction and computer analysis articles have been written about full-wave horizontal loop antennas, there has never been an article in which the real-world performance of these antennas was compared to other wire antennas. In this article, I will try to share what I've gleaned from my many years of antenna experience.

For the record, my QTH is located in northern New Jersey, and is approximately 300 feet above sea level. My square, coax-fed, 80-meter loop is located approximately 40 feet above the ground. I also have a pentagonal 160-meter full-wave loop, fed with 450-ohm open-wire, at approximately 60 feet of elevation.

I have used my horizontal loop antennas for many years, enjoying thousands of contacts with amateurs who used a large variety of antennas, and have had hundreds of in-depth discussions with other hams who use loop antennas. Both of my loop antennas are solid performers on their fundamental frequency, and the 80-meter version provides excellent performance on eight amateur bands (10–80 meters).

I am a casual DXer and an avid ragchewer, and my two loops have helped me to earn WAS and WAC on all HF bands. I also have more than 100 countries confirmed on each of six HF bands, and over 60 countries on each of the rest. One highlight on 160 meters was an "S-7" from a VK5, in southern Australia, 10,000 miles from my QTH. He reported that my "cloud warmer" was giving him the only signal he could hear well enough to work at that time.

The following advantages have been noted by most users of horizontal-loop antennas:

•Better than average performance on all HF and SWL bands.

•Simple, low-cost installation which does not require traps, baluns, or tuning and pruning. Just install it according to the measurements in **Table 1**.

•The antennas are inconspicuous, and provide good performance at lower heights than most other wire antennas.

•SWR of less than 3:1 (see **Fig. 1**) at some point in every HF band, allowing the built-in automatic antenna tuners in most new HF rigs to provide a proper power transfer to the antenna.

Continued on page 18

Band	Length of Each Side	Total Length of Wire	Minimum Height Above Ground
40 m	35 feet	140 feet	20 feet
80 m	70 feet	280 feet	40 feet
160 m	135 feet	540 feet	60 feet

***Table 1.** Construction details for full-wave multiband horizontal loops.*

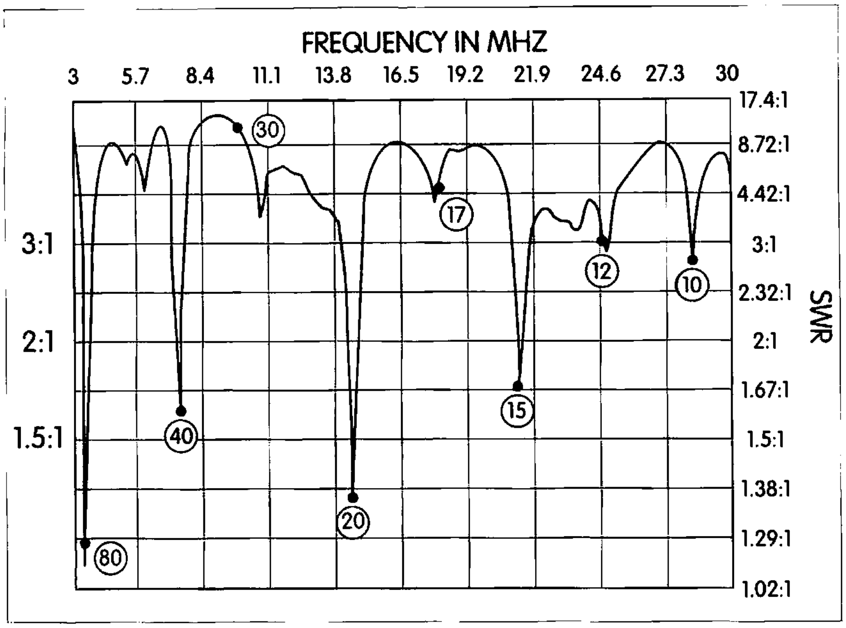


Fig. 1. All bands chart. Relative SWR vs. frequency for the 80 m loop, as measured with a Hewlett-Packard 3577A Network Analyzer.

•Some noise cancellation, due to the closed-loop design, when compared with open-ended type antennas.

•High-Q with low feedpoint impedance (20 to 200 ohms) and good bandwidth.

•Large capture area with less QSB or fading.

•High efficiency with 3- to 18-dB apparent gain over other simple wire antennas.

There are few disadvantages, and these are usually related to the individual preferences of the owner or the physical constraints created by his location. The disadvantages most often mentioned are:

•Large size (up to 140 feet per side, and 200 feet diagonally, for the 160-meter version).

•The need for four conveniently-placed tall supports.

•Some sort of inline tuner is necessary.

•The radiation pattern is more or less omnidirectional.

About a decade ago, I gave an antenna lecture at a local radio club. During the question-and-answer phase, I was given a friendly challenge to prove my statement that an 80-meter horizontal loop provided good DX performance on the 75-meter phone band. That challenge lead to a series of real-world comparisons of loops, single- and multiband wire antennas, and a couple of beams. I hope that reporting these actual results will dispel the commonly-accepted myth that horizontal loop antennas, at their fundamental frequencies, are cloud warmers useful only for local contacts.

Several local hams agreed to join in the antenna tests. During the first test, we were all located within five miles of each other, each had his antenna in the clear, and our elevations were all between 200 and 300 feet above sea level. To keep the results as fair as possible, we all agreed to use a power level of only 100 watts. My antenna was the 80-meter loop at a height of about 40 feet above the ground, test antenna #1 was a 75-meter dipole at 60 feet above the ground, and test antenna #2 was a 75-meter inverted vee at approximately the same height.

Our first contacts were with hams located 75 to 100 miles from Park Ridge (New Jersey). We found the loop to have as much as a 40 dB advantage over the dipole and inverted vee, proving that the loop certainly does have considerable high-angle radiation. Next, a group of five hams scattered around the Midwest volunteered to help in our tests.

Rank	Antenna Type (mounted at 40 feet)	Performance Characteristics:			
		Ground Wave	Short Skip	Long Skip	Short Term Fade
1	Full Wave 80 m Horizontal Loop	fair	excellent	good–excellent	very good
2	Centerfed Zepp	poor	very good	fair–good	poor
3	Inverted "L" (130 feet long)	good	good	fair	good
4	Windom	fair	very good	fair	poor
5	Multiband Trap Dipole	poor	very good	fair	poor
6	G5RV	poor	good	poor	poor
*	2-Element Multiband Quad	very good	good	excellent	very good
*	Trap-Type Triband Yagi	good	fair	good–excellent	fair
*	Half Wave Vertical	excellent	fair–good	good	poor

Table 2. Wire antennas, ranked by all-around performance. (*) indicates the antenna referred to is not a wire antenna; used for comparison only.

The transmitted signals from the loop averaged one and a half S-units better than the other antennas. On that static-prone night, my receive capability was Q-5, while my friends were having some trouble copying the Midwest stations through the static crashes. West Coast stations who had been following the test from a distance of approximately 3,000 miles agreed that the signal from the loop had a one S-unit advantage over the dipole and inverted vee.

We then turned our attention to Europe and beyond, working stations up to 5,000 miles away. We contacted hams in several different countries, in an attempt to eliminate any advantages in directivity one antenna may have had over another. The loop still exhibited at least a 3 dB advantage over the dipole and inverted vee, and in some cases was up to one S-unit better, according to the stations we worked.

The evening ended with a discussion on two-meter FM, as we analyzed the results of our tests. We all agreed that the 80-meter loop was the clear-cut winner and had a distinct edge over the dipole and the inverted vee at all distances. Since that time, one of the testers has installed his own 80-meter loop and has achieved similar results when comparing the loop and the inverted vee at his home.

The results on 75 meters prompted me to think that we should expand our testing to include all HF bands and many of the popular multiband wire antennas. Approximately five years ago, I organized several members of the State Line Radio Club of New York and New Jersey to help with the testing program. We spent several months of our spare time on this project, and in the process made hundreds of SSB contacts on all HF bands, at all times of the day and night, with stations both near and far.

We tried to eliminate the effects of QSB by having each station make several short transmissions of its callsign, repeating the process until the receiving station was certain that it could rank each antenna type against the others. Many times stations who were listening to our tests would break in with

reports from other areas, and we would record their results as well. We felt that accepting all reports from any area would help equalize any directivity exhibited by any of the antennas in our test group.

After several weeks of testing, certain patterns began to emerge from the accumulated data. We were quite surprised to discover that some types of antennas performed better than we would have anticipated and some performed more poorly. In some cases, we repeated the tests when two or three antennas appeared to be nearly equal in performance, so that we were able to definitively rate the antennas. Some other hams who joined our test program had quads, yagis, or vertical antennas, and their results were included for comparison to the multiband wire antennas.

As the tests came to a close months later, we were excited to sift through the many reports and come up with our rankings. **Tables 2** and **3** show the results of our real-world tests. Please remember that the wire antennas and beams used in our tests were average antennas erected by average hams.

Of the multiband wire antennas, the 80-meter horizontal loop was the best all-around performer. In fact, not one of the other multiband wire antennas outperformed the loop on any band or at any distance. At times, one or another of the antennas would equal the loop in performance, but not on a consistent basis. As you can see, each antenna had its shortcomings, and some of the more widely-publicized antennas do not even come close to meeting their reputations.

Our on-the-air testing has allowed me to offer the following tips if you want to install your own horizontal loop antenna:

•A four-sided quad provides better multiband harmonic performance than a three-sided delta. Rectangles or pentagons also work well.

•The loop seems to work better when corner-fed with 75-ohm coax instead of 50-ohm coax. (Varying the feedline length may improve multiband matching.)

•A multi-turn coaxial-coil RF choke placed at the feedpoint of the antenna works well to keep RF off the shield.

•450-ohm open-wire used as a feedline for the 160-meter loop provided dramatically improved performance over coax when this antenna was used on 20 meters and higher.

•Higher is not necessarily always better, but the loop should be at least 1/8-wave above ground on the fundamental frequency.

One final test may be of interest. A fellow club member purchased and installed a new 70-foot tower and one of the better-rated linear-loaded triband beams following our initial tests. His old trap tribander on a 50-foot tower had been outperformed by my loop on several occasions, and he was looking

Antenna Type (40–50 feet above ground)	Cost	Radiation Pattern	Feed Line	Optimum Results	Tuning Requirements	Notes
Full Wave 80 m Horizontal Loop	Low	Many lobes and nulls on higher bands	Coax or open line	10–80 m; very broad-banded	T-match with balun	Needs 4 supports. Excellent low-noise antenna, including SWL.
Centerfed Zepp	Low	Varies with band	Open wire	On several bands	Balanced-wire tuner	Classic multiband antenna. Used over 60 years.
Inverted "L"	Low	Varied lobes and nulls	Coax	Only on a few bands	Wide-range tuner	Quite directional on higher bands.
Windom	Low	Varied lobes and nulls	Open wire or coax and special balun	Only on a few bands	Wide-range tuner	On some bands, open-wire portion is part of antenna.
Multiband Trap Dipole	Low to Medium	Bidirectional	Balun or coax	On several bands, when mounted high above the ground	None, if properly made	The old standard. Fair for DX.
G5RV	Low	Varies with band	450-Ω wire line to balun and coax	On resonant band	T-match	Compromise antenna, poor for DX.
2-Element Multiband Quad	Medium to High	One main lobe	Coax	On a maximum of 5 resonant bands	Built-in match at antenna	Needs tower and rotator. Height not as critical as with yagi.
Trap-Type Triband Yagi	High	One main lobe	Coax	On resonant bands; 10 m, 15 m, 20 m	Built-in match at antenna	Needs tower and rotator. Higher is better.
Half Wave Vertical	Medium	Omnidirectional	Coax	10–20 m	Built-in match at antenna	Good for limited-space applications.

Table 3. Results of antenna comparisons.

for revenge! As we scouted the 20-meter phone band, we located a Tasmania (VK) station who was willing to compare our signals, and as we started testing, a local "Big Gun" asked to join the test. We agreed, thinking that his participation would provide for more interesting results. The Big Gun was definitely a Big Gun superstation. He had stacked monobanders on a 110-foot tower and a three-tube Alpha capable of 3 kW!

The first report from the VK showed that the kilowatt-fed tribander and the 80-meter loop were S-6, and the Big Gun was S-9 in Tasmania. When the Big Gun turned off his Alpha, we were all S-6! Now, who do you think got the most satisfaction from these reports? My friend with the new $1,200 tower and tribander, the Big Gun with his $10,000 antenna system, or me with my $20 horizontal loop?

You may disagree, but after 20 years of general hamming, DXing, and occasional contesting, I am extremely satisfied to have accomplished so much with such a minimal investment. My 80-meter horizontal loop antenna consistently outperforms all other simple multiband wire antennas and usually holds its own on the higher bands when compared with ordinary yagis installed at ordinary heights. If you decide to try one, you will not be disappointed!

As a final note, I would like to thank all the local and worldwide hams who have made this article possible through their patience and enthusiasm for our antenna testing project. 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 64 for ordering information.

Crystal Set Building

This book is packed with 168 pages of easy home crystal radio projects. Your batteries will never wear out with these radios. They might even make a great science fair project. These projects are reprinted from Volumes 6 and 7 of The Xtal Set Society Newsletter. They do have some tube sets and TRF's too. Great weekend projects. $16.

Intro to Superhets

Part 2: From oscillators to detectors.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

This is the second part in the series on the introduction to superheterodyne receivers. The first part covered the history of the receiver's development and began a discussion of the stages within the receiver. The next stages to be discussed now begin with the oscillator and end with detectors. Part 3 will discuss some of the more popular accessory circuits used with superhet receivers.

Oscillator

The purpose of an oscillator is to provide a local signal to beat against (mix with) the incoming signal at the mixer to provide superheterodyning action. There are many different types of oscillators and they fall into basically two categories: fixed and tunable. Fixed oscillators may be crystal-controlled, synthesized PLL, or direct digital synthesized. The objective is to provide a very stable oscillator signal. And, if synthesized, it will usually be adjustable to a multiple number of discrete frequencies.

A tunable oscillator is of the type used in low-end broadcast and FM radios. The oscillator is free-running and varied in frequency by changing either the tuning capacitance or inductance. The objective of using a tunable oscillator in a modern receiver is to accommodate low cost and compactness, and perhaps to be less complicated than utilizing a synthesizer.

One of the specific requirements of the oscillator is to provide a stable signal free of distortion. This means that the oscillator waveform must be as close to a sine wave as possible. Should distortion be present in the oscillator output, the signal would create multiple mixes generating many spurious signals. The IF would be flooded with a series of spurious signals resulting in mixes which would confuse the listener, should they propagate through the receiver. In any case, the spurious signals would increase the receiver-generated noise which could mask a desired incoming signal.

IF amplifier

More and more signals are being transmitted each day as the need for communication increases. With only a given amount of frequency spectrum available, it is necessary to crowd these signals close together to make room for others. The receiver must select the desired signal and reject all others.

To do this, the IF amplifier in the receiver must have a narrow passband to allow only a narrow range of frequencies to pass. Multiple-tuned resonant circuits, ceramic and crystal filters, and mechanical filters are the methods used for narrowing the passband.

The property of a receiver to pass a narrow range of frequencies is called selectivity. The selectivity of an IF amplifier is a measure of the total response of all of the tuned circuits in the amplifier. A typical IF response curve is shown in **Fig. 1**. The broadness of the peak portion of the curve for each tuned circuit depends upon its

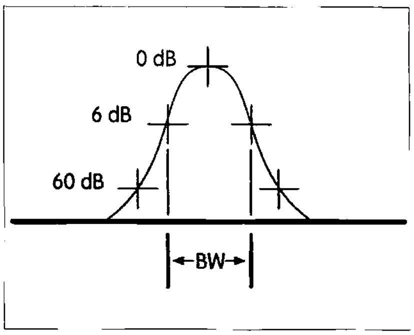


Fig. 1. *IF response curve showing where bandwidth is measured at 6 dB points as a function of voltage levels.*

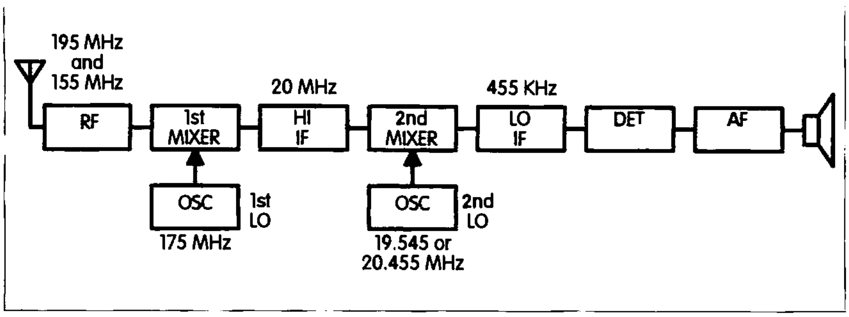


Fig. 2. Dual-conversion superheterodyne receiver showing desired and image signal inputs. Alternate second local oscillator frequencies are shown.

Q factor. In general, the response of a tuned circuit is given approximately by the relation:

$$\text{Bandwidth (kHz)} = \frac{\text{Tuned frequency (kHz)}}{\text{Q of tuned circuit}}$$

The sensitivity of an IF amplifier is determined by measuring the signal-to-noise ratio. In the past, the sensitivity was determined by comparing the signal level to noise quieting with the result indicated in decibels, but signal-to-noise ratio is more definitive as a measure of sensitivity.

For the IF amplifier to perform properly, it should have sufficient gain to amplify the weak signal output from the mixer to a level sufficiently high to drive a detector. Consider the fact that an IF theoretically could function with a gain of perhaps one, and doing so might not generate any noise that would contribute to the masking of an incoming signal.

The question arises then as to how the signal amplitude could be raised to be usable by the receiver operator. If the signal is sufficiently strong to be detectable, the increase in desired amplitude could be accomplished all in

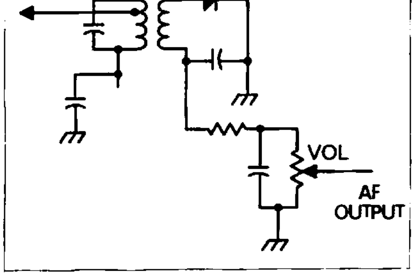


Fig. 3. A diode used as an AM detector.

the audio amplifier, where noise generation is reasonably easy to control. Although this concept holds some promise, it is typical to have considerable signal gain in the IF amplifier because some detector circuits are very dependent upon the incoming signal level being above a threshold value for that detector to function.

Selection of the proper IF amplifier frequency is important and is the decision of the receiver designer. If the IF passband is too narrow, a tunable receiver will be difficult to tune; if too wide, the receiver may not be selective enough. There are many standard frequencies that have been used over the years for the IF, with 455 kHz and 10.7 MHz being very common. Should a low-frequency IF be selected for, say, a VHF/UHF receiver, the potential for images is very high, causing severe interference problems. By raising the IF amplifier frequency, the interference can be reduced and possibly eliminated. However, the bandwidth of the receiver will be increased and may allow adjacent channel signals to enter the receiver.

The receiver should have multiple conversions, to obtain image rejection and to achieve a narrow passband. If two conversions are utilized, the receiver is called a double conversion receiver. This is shown in **Fig. 2**. The receiver has a desired input frequency of 155 MHz and a first IF of 20 MHz. The oscillator frequency is placed above the input signal to eliminate images from aircraft at 115 MHz. With the oscillator at 175 MHz, the image would be at 195 MHz. The high frequency first IF stage places the image

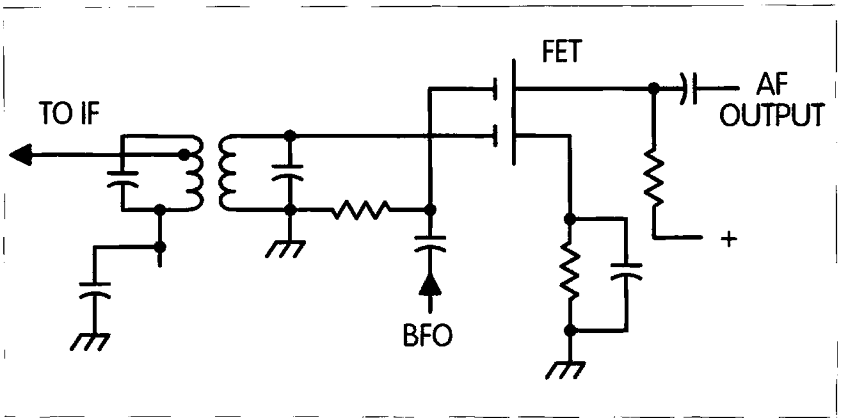


Fig. 4. A product detector implemented with a dual-gate FET.

40 MHz away from the desired incoming signal and essentially eliminates the image completely. Then, to obtain selectivity in the receiver, a low-frequency second IF at 455 kHz is used. The second conversion converts the 20 MHz signal to 455 kHz by beating the 20 MHz signal against a low-frequency oscillator of either 19.545 or 20.455 MHz.

The low-frequency oscillator may be placed above or below the high IF amplifier frequency. The only concern here is whether the harmonic of the low-frequency oscillator signal creates an interference problem at the receiver's input of 155 MHz. The eighth harmonic of the 19.545 MHz frequency is 156.36 MHz, which is 1.36 MHz away from the desired input at 155 MHz and little, if any, interference would occur. But if interference *should* occur, the 20.455 MHz frequency would be considered as an alternate following the same analysis.

After the high-frequency IF moves the image outside of the receiver's front end passband, the low-frequency IF is then used to narrow the passband to provide the desired selectivity.

Converting RF from one frequency to another has become the norm in receiver design, but there is a simpler design that is currently being used with success in the ham bands. The receiver is a direct conversion superhet that converts the RF directly to audio. Direct conversion eliminates the IF amplifier, but does generate a new set of problems requiring resolution. One of the major issues is having the oscillator (LO) operating essentially at the same frequency as the incoming signal. As a result, the LO output must be isolated from the incoming signal path. When used as a CW receiver, the LO doubles as the BFO.

Some nonsynthesized ham band receivers use a crystal-controlled first oscillator that is switched to achieve various bands and/or band sections. Each band/section is tuned by tuning the frequency of the second conversion oscillator. The objective of crystal-controlling the first conversion and tuning the second is to provide stability in the first converter and bandspread capability with the second.

In the past, when the receiver was to be used to receive FM signals, the last stage or two of the IF operated as an amplitude limiter to effectively remove any amplitude variations in the received signal, providing FM with a relatively noise-free performance. Limiter action was created by operating the stage at a high gain and having a low signal saturation threshold. When a signal was received, the limiter would create a DC bias relative to the strength of the incoming FM signal. The DC bias on the input would reduce the dynamic range of the stage, causing it to limit its amplitude response. In other words, the output amplitude remained fairly constant over a fairly wide range of input signal amplitude variations. Since most noise creates a voltage amplitude change, the limiter was effective in stripping the noise off the incoming signal. The limiter was required specifically when the FM detector was a Foster-Seeley discriminator, which was sensitive to both amplitude and frequency signal changes. Other types of FM detectors tend to be self-amplitude-limiting, which eliminates the requirement for having IF amplifier limiters.

However, one of the effective features of using an IF amplifier limiter is that all signals reaching an FM detector will be of equal amplitude. When the signal amplitude to the detector is a constant, the recovered audio level is then a function of the frequency deviation. For the user, this is important because all received signals from a specific service would tend to sound equally loud. Unlike FM, signals received by an AM receiver will have an audio recovery that is dependent both upon the strength of the received signal and the percentage of modulation used. Automatic gain control (AGC), originally called automatic volume control (AVC), was utilized to assist in keeping the recovered audio level at a near-constant value by attempting to control the sensitivity of the overall receiver through individual stage gain control.

Detectors

In the discussion of receivers up until now, little concern had been expressed regarding the type of modulation that exists on the received signal (carrier). Each transmitted signal has a carrier (present or suppressed) that has been modulated in order to transfer intelligence from the transmitter to the receiver. The purpose of the detector is to demodulate the received signal and recover the modulation. To gain an understanding of how the detector functions, let's discuss typical detectors for each modulation type.

AM detector

An AM detector is perhaps the simplest of all detectors, consisting simply of a diode (see **Fig. 3**). The diode operates as a half-wave rectifier, rectifying all signals that appear at the output of the IF amplifier. The detected output follows the modulation envelope of the received signal. Once the signal arrives at the

detector, the carrier is no longer required and is separated from the modulation to leave just the audio. To perform this operation, an RC filter is used, usually consisting of two capacitors and a resistor. The filter is typically also used as the de-emphasis network that reshapes the recovered audio to make it sound normal. Without the de-emphasis network, the audio would sound "brilliant" with an overabundance of highs. During the transmission of AM signals, the higher audio frequencies tend to be less emphasized than the lower frequencies. As a result, it is necessary to increase the amplitude of the higher audio frequencies through pre-emphasis to make up for the loss during transmission. After filtering out the carrier, the recovered modulation is an audio voltage that has been reshaped to match the audio entering the transmitter's microphone.

Although the diode detector was most suitable for AM, it could also be used for slope detecting FM. One of the difficulties of slope detection is the loss of audio amplitude as the signal deviation approaches the bandwidth of the IF, creating distortion in the recovered audio.

Product detector

In the case of single sideband (SSB), the carrier and one set of modulation sidebands are intentionally suppressed at the transmitter, leaving only one set of sidebands to be transmitted. When the signal arrives at the receiver, the carrier must then be restored in order to demodulate the sideband properly. Restoration of the carrier is accomplished by using a local oscillator for "carrier reinsertion." All of the transmitted intelligence is carried in one set of sidebands, which permits the suppression of one set at the transmitter. In addition, no intelligence is transmitted in the carrier; therefore, suppressing the carrier and one sideband allows all of the available transmitter power to be applied to the one transmitted sideband.

Another form of amplitude detector, as shown in **Fig. 4**, is the product detector used for demodulating an SSB signal. There are many different circuit designs available for use. The name "product" comes from the fact that two incoming signals are multiplied together to form the resulting output. One of the incoming signals is the local oscillator used for carrier reinsertion, and the other is the received signal exiting the IF. The carrier reinsertion level is fixed in amplitude and, essentially, added to the incoming modulation envelope of the SSB signal. The resulting output is an audio voltage that follows the modulation envelope pattern of the transmitted signal.

There are many differing designs for a product detector, but each does essentially the same job in the demodulation process. Of concern is that the local-carrier amplitude be as high as possible in order to minimize intermodulation distortion products, yet isolation is essential in preventing the oscillator signal from feeding back into the IF.

As in the AM detector, all RF signal energy must be removed before the audio is presented to the audio amplifier. An RC filter is used for this purpose.

FM detectors

An AM detector may be used to detect FM, but the performance of the receiver would be poorer than if an FM detector were used. An FM detector is somewhat more complex than an AM detector, and there are many available. Each operates on the principle of converting a changing frequency (deviated signal) to an amplitude-changing voltage, where the method of detection may relate to an amplitude change as a function of frequency, a phase shift, or a detection of the actual frequency shift. To see how each type functions, let's examine a few of the typical detectors used over the years of receiver development.

Foster-Seeley discriminator

A Foster-Seeley discriminator as shown in **Fig. 5** was the staple of FM detectors for a long period of time. It was really a takeoff on the AM detector from the standpoint that it is sensitive to both amplitude and frequency

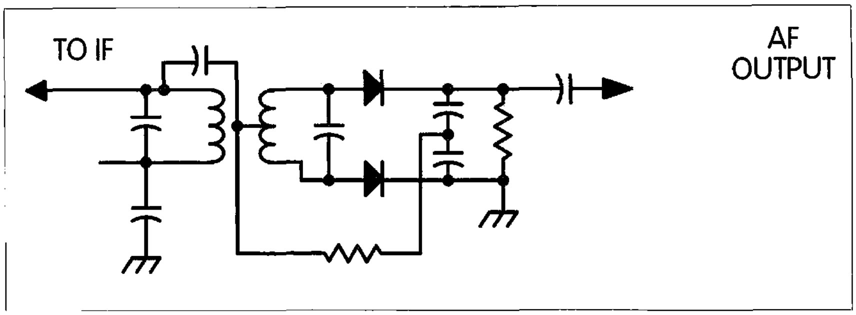


Fig. 5. Typical Foster-Seeley FM discriminator.

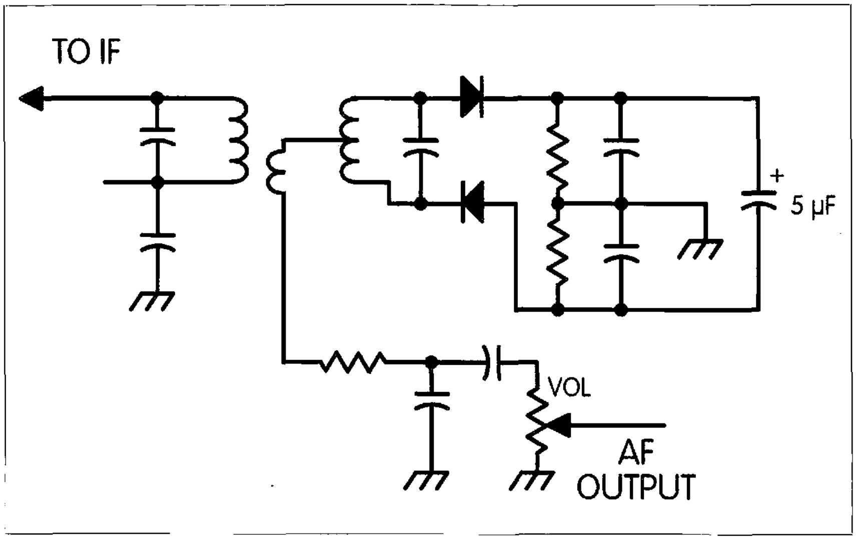


Fig. 6. Typical ratio detector for FM demodulation.

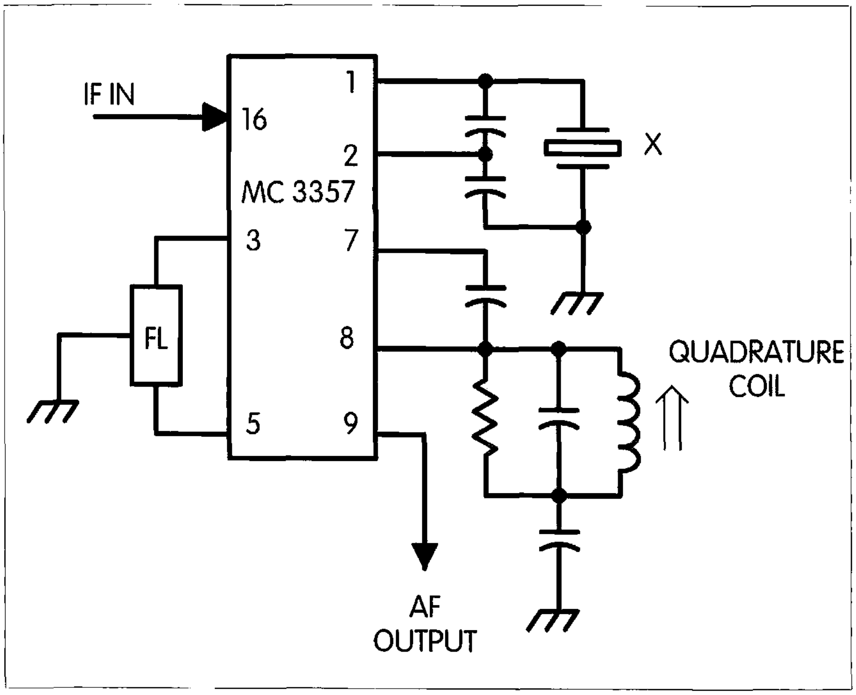


Fig. 7. Quadrature detector for FM demodulation utilizing an MC3357. The quadrature coil operates at 90 degrees from the signal through FL.

changes. The amplitude sensitivity aspect was "cured" by preceding the detector with an IF limiter. Then the recovered audio amplitude was in direct proportion to the frequency deviation. In looking at **Fig. 5**, you can see that a coupling capacitor ties the top of the primary winding to the center tap of the secondary winding, and both windings are tuned to resonance at the intermediate frequency. As a result, the secondary winding is provided both inductive and capacitive coupling to the primary, developing an IF voltage across the secondary, which is 90 degrees out of phase with the primary. Each diode receives an equal voltage to be rectified, and the diode output differential will be zero when the carrier is centered within the receiver's passband. When the incoming signal moves (deviates) to one side or the other from the zero point, then each diode will conduct a current which is proportional to the frequency shift from zero. This results in a differential voltage produced at the detector output which is relative in magnitude to the amount of deviation. The recovered audio is usually filtered and shaped with an RC filter before the audio voltage is presented to an audio amplifier.

Ratio detector

Ratio detectors, as shown in **Fig. 6**, operate on the same principle of a 90-degree phase shift between primary and secondary windings as a Foster-Seeley discriminator. However, the voltage developed across the output circuit remains fairly constant because the diodes conduct in series, aiding, not opposing as in a discriminator. The output voltage produced across the 5 µF capacitor is proportional to the strength of the received signal, rendering the detector insensitive to noise and AM signals. The large capacitor is used to provide a long RC time constant for limiting amplitude variations. Although an IF limiter was not required ahead of the ratio detector for noise elimination, the detector was still responsive to the amplitude strength differences between received signals, meaning that one station might sound louder than another. The

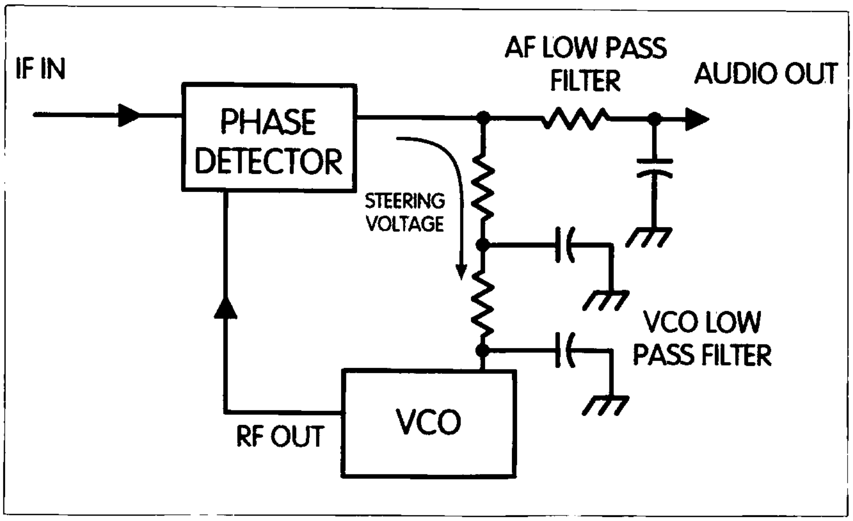


Fig. 8. PLL FM demodulator. VCO steering voltage follows the frequency deviation of the incoming signal.

use of an IF limiter "cured" that problem when the need was critical.

Audio output from the detector was taken from the center tap of the secondary winding, where the recovered audio voltage amplitude was proportional to the shift in the deviated carrier.

Quadrature detector

Quadrature detectors were originally developed for TV receivers because they were inexpensive and easy to implement. However, a special tube type was required for the circuit. Then, with the advent of solid state radios, a solid state version of the detector was developed, which is now pretty much a standard for communications radios. The most popular IC used for receiver IF and detector circuits is the MC3357, a portion of which is shown in **Fig. 7**, which incorporates the electronics portion of the quadrature detector circuit. A quadrature coil is used external to the IC as a reference signal for detecting the deviation of a received signal. In essence, when a signal is received, a portion of the signal is split off and used to excite the quadrature coil, causing it to resonate at the intermediate frequency. In a quadrature detector, a 90-degree phase shift exists between the voltage produced by the coil and the incoming signal. The two resulting voltages are compared and produce an audio voltage proportional to the signal deviation. An RC filter is used at the audio output to shape the audio being presented to the audio amplifier.

Phase locked loop detector

Phase locked loops (PLL) are used for many purposes. One of the prime ones is generating a multitude of available frequencies, each having the stability of a crystal. Using the PLL as a detector, as shown in **Fig. 8**, follows the principle of tuning the VCO to the intermediate frequency and allowing the VCO to lock to the incoming signal. A phase detector exists between the VCO and the incoming reference signal and is used to compare the phase of the two signals. The phase difference between the two input terminals is 90 degrees, and a DC output voltage will be produced which is proportional to the difference in the phase between the two signals. A long time constant is utilized at the steering voltage input to the VCO, to prevent the VCO from following the deviation of the incoming signal. What this means is that the steering voltage, while attempting to drive the VCO, will be proportional in magnitude to the amount of deviation of the incoming signal. Audio is then recovered from the steering voltage line between the phase detector and the VCO. Three of the more popular PLL detector ICs have been the NE560, NE565, and the 4046. A resistor and capacitor are used for adjusting the frequency lock range of the internal VCO.

Next time: Accessory circuits can make superhet receivers more user-friendly, as well as adaptable to many applications.

73 Review

Build the NHRC-4 Linking Repeater Controller

...And get with the program.

Jeff Otterson N1KDO
3543 Tritt Springs Way
Marietta GA 30062

Peter Gailunas KA1OKQ
444 Micol Road
Pembroke NH 03275

Rich Cox N1LTL
452 Brown Road
Candia NH 03034

The unexpected success of our earlier repeater controller project ("Build a $60 Talking Repeater Controller," *QST*, February 1997), including user feedback, prompted us to design another low-cost controller project. NHRC-2 users wanted another simple repeater controller with linking capability. We thought about their requests for a while, and then we designed this project: the NHRC-4 Linking Repeater Controller. You'll find information about kits and assembled and tested units at the end of this article.

The NHRC-4 controller will easily integrate to any repeater. It has two radio ports: primary and secondary. The primary port supports a normal full-duplex repeater, while the secondary one can be used for a remote base, a link radio, or a "slave" repeater.

The controller supports all the standard controller features: CW ID, courtesy tones, and timers for the ID; "hang" or "tail" timer; and an individual timeout timer for each port. The CW messages, timer values, and other parameters are all programmed over the air with DTMF command sequences. The controller has LED indicators for PTT and CAS for each port, and a DTMF indicator for the primary port. There are expansion connectors for both ports to support external digital delay boards, which can eliminate squelch tails and the leading edge of DTMF sequences.

Each port can have a distinct courtesy tone to indicate to repeater users which receivers are active. There are five different events that can trigger a courtesy tone, and each tone can be programmed independently. The five events are: the primary port's receiver dropping; the primary port's receiver dropping while the secondary port's receiver is active and "alert mode" is selected; the primary port's receiver dropping when the secondary port's transmitter is enabled; the secondary port's receiver dropping; and the secondary port's receiver dropping when the secondary port's transmitter is enabled.

There are four different modes for the secondary port. The secondary port can be off, where nothing is received, transmitted, or otherwise indicated from the secondary port. It can be in "alert mode," where activity on its receiver is indicated by a distinctive courtesy tone on when the primary port's receiver drops. (This mode is particularly useful in the remote-base environment to indicate channel activity without having to actually listen to the channel activity on the remote base.) The secondary port can also be in "monitor mode," where its receiver audio is transmitted over the primary port's transmitter. A unique courtesy tone indicates that the repeated signal originated from the secondary port. The fourth mode is the "transmit" mode, where the secondary port transmits the signal received on the primary port's receiver, and the primary port's transmitter repeats both the primary and secondary port's audio.

The secondary port's PTT (push-to-talk) signal can be programmed to

follow the primary port's CAS (carrier-activated switch) signal, or the primary port's PTT signal. Following the CAS signal is typical for remote base and linking applications, and following the primary port's PTT signal is typical for a slave repeater.

The controller also has one digital control output. This output can be turned on or off or be pulsed by DTMF remote control, or the output can be configured to operate a transmitter fan, which will be turned on when the transmitter is turned on, and run for a programmable amount of time after the transmitter turns off.

Circuit description

The controller's circuitry is quite simple, consisting of some digital level conversion networks for the CAS and PTT interfaces, audio mixing and gating, and DTMF reception, all orchestrated by a Microchip PIC 16F84 microcontroller. The 16F84 manages all controller functions. It provides internal EEPROM to store the controller's program, as well as the user-programmable CW messages, timer values, and so forth, and RAM for the program's operating variables.

DTMF is decoded by a Tel-Tone M8870 DTMF receiver, which also supplies the 16F84 with a clock signal. A quad op amp, a voltage regulator, and a handful of discrete components round out the design.

The circuit alone would do nothing without the custom software programmed into the 16F84. The control program contains approximately 900 instructions. The software provides all the logic, and generates the timers and programmable courtesy tones for the controller.

Electrical connections

The controller uses an eight-pin, 0.100 header for all the primary radio's signals and DC power; a six-pin, 0.100 header for the secondary radio's signals; and a six-pin, 0.100 header for an external TS-32 CTCSS encoder/decoder for the primary radio. In addition, it has two four-pin, 0.100 connectors to support optional NHRC-DAD digital audio delays for both radio ports.

Each radio port requires audio and a signal present indication (CAS) from its receiver, and supplies transmit audio and PTT to its transmitter. The controller requires 13.8 VDC for power, which is provided on the primary radio's connector. (Be very careful when wiring DC power to the controller—reverse polarity will severely damage the controller.)

Receiver audio can typically be taken from the high side of the squelch control. This audio must be de-emphasized with the controller's de-emphasis circuit, which provides a -6 dB/octave slope. Optionally, audio can be taken from later in the receiver's audio chain, where it is already de-emphasized. Care must be taken that this source of audio is not subject to adjustment by the radio's volume control. If the receiver audio has not been properly de-emphasized, either in the receiver itself or on the controller board, the repeater will have a very "tinny," unnatural sound to it. The NHRC-4 repeater controller can be built with a de-emphasis circuit populated on the printed circuit board, for "flat" audio response. To install the de-emphasis filter, two 100 k resistors must be removed, and 51 k and 510 k resistors added, as well as a .0068 µF. Consult the NHRC-4 Repeater Controller (audio) schematic for modification instructions.

The receiver must provide a signal present indication (also called CAS, COR, RUS) to the controller. The controller requires an "active-high" signal here. If your radio only has "active-low" signaling available, a simple inverter can be constructed with a 2N3906 and a 4.7 k resistor. Connect the emitter of the transistor to a source of positive voltage, the collector to the controller's CAS terminal, and the base to the active-low signal through the 4.7 k resistor.

Transmitter audio can be fed directly into the microphone input of the transmitter. VR5 is the master level control for the primary radio, used to set the audio level into the transmitter. VR2 is the master level control for the secondary radio. The transmitter's deviation limiter (sometimes called IDC) should

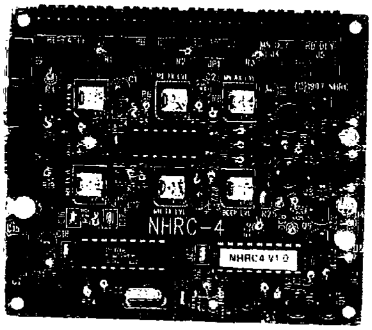


Photo A. NHRC-4 Version 1.0 board, top view.

be set such that the transmitter cannot overdeviate, regardless of input signal level.

One way to adjust transmitter deviation is to set the transmitter deviation limiter wide open (unlimited), adjust the controller's master output until the transmitter is slightly overdeviating, and then set the transmitter's deviation limiter to limit just below 5 kHz deviation. Then reduce the controller's master output until the transmitted audio does not sound compressed or clipped. Transmitter deviation should be adjusted with a service monitor or deviation meter.

Transmitter keying is provided by a power MOSFET (Q2/Q6) configured in an open-drain circuit. This can be used to key many transmitters directly. The MOSFET essentially provides a closure to ground for PTT. For other transmitters, the MOSFET can drive a small relay to key the radio. Although this MOSFET can handle several amps, we recommend that no more than 500 mA of current be drawn through it.

The LED status indicators

The NHRC-4 repeater controller is equipped with five status LEDs that aid in setup and troubleshooting. There are green LEDs for each radio port that indicate that the controller is getting a valid CAS (carrier-operated switch) and, if a CTCSS decoder is connected, a valid CTCSS decode signal. This LED should light when the repeater's receiver is active and, if a CTCSS decoder is present, indicate that the correct CTCSS tone is present. The yellow LED indicates that a DTMF signal is being decoded on the primary receiver. This LED should light for the entire duration that the DTMF signal is present on the primary receiver. The red LEDs indicate transmit. These LEDs will light when each transmitter is transmitting. The LEDS can be disabled to reduce the power consumption of the controller. Remove jumper JP2 to disable the LEDS.

TS-32 hookup

Connector J3 is a six-pin header that allows the easy installation of an optional Communications Specialists TS-32 for CTCSS decode and possibly encode. The TS-32 must have the JU-2 jumper cut. If you want to be able to disable the CTCSS requirement, install a switch on the HANGUP lead, or you could wire the HANGUP lead to the J1 Fan/Digital Output pin to allow remote enable/disable of the CTCSS requirement.

If you like, you can wire the TS-32's ENCODE OUT pin into your transmitter's CTCSS input to encode PL on the repeater's output. The TS-32 is normally configured with its high-pass filter in-circuit to remove received CTCSS tones. Jumper JP1 on the controller board must be removed when the TS-32 high-pass filter is used. If the TS-32 is not installed, then jumper JP1 must be installed in order for audio to pass through the controller. Consult the TS-32 INSTRUCTION SHEET for details on setting the CTCSS frequency.

Installing the audio delay

The audio delay for the primary radio simply plugs into J4. The audio delay for the secondary radio plugs into J5. If the audio delay is not installed, a jumper between pins 2 and 3 of the port's delay connector must be installed, or the controller will not pass audio.

Using the digital output

The NHRC-4 Repeater Controller has a digital output that can be used for various remote control applications or to control a fan on the repeater's transmitter. The digital output is an open-drain into a power MOSFET, which is capable of sinking quite a bit of current, but we recommend a maximum load of about 500 mA. Use a relay to drive larger loads. The open-drain output can be used to gate the HOOKSWITCH signal to a TS-32 or other CTCSS decoder. Software allows the output to be enabled, disabled, or pulsed. In fan control mode, this output will be turned on when the transmitter is turned on, and turned off a programmable amount of time after the transmitter is turned off.

Adjusting the audio levels

Preset all potentiometers to midrange. Key a radio on the primary input frequency, send some touchtones, and adjust VR4 (the primary receiver level) until DTMF decoding is reliably indicated by yellow LED D5.

The primary radio's transmit deviation is set with VR5 (the primary transmitter master level) on the controller board and the transmitter's deviation/modulation control. The key to properly adjusting these controls is to remember that the limiter in the transmitter is after VR2 but probably before the transmitter's deviation/modulation control. The transmitter's deviation/modulation control will set the actual peak deviation, and VR5 will set the level into the transmitter. You do not want excessive limiting on normal speech going through the repeater; it sounds bad and tends to "pump up" background noise. On the other hand, some limiting is desirable. An oscilloscope connected to the audio output of a receiver tuned to the transmitter's frequency will show limiting as the audio gets "flat-topped" or clipped by the limiter. Ideally, a 4.5 kHz deviation signal input to the repeater should result in a 4.5 kHz deviation output, and 5.5 kHz of input deviation should result in just under 5.0 kHz of deviation out of the repeater. A service monitor (or two), deviation meter, and/or a signal generator are necessary to do this job right.

The secondary radio's transmit deviation is set with VR2 (the secondary transmitter master level). Enable the secondary transmitter, and adjust VR2 for proper transmit deviation, similarly

to what was done with VR5. Enable the secondary receiver, and adjust VR1 for reasonable deviation on the enabled transmitters when a signal is received on the secondary receiver.

Adjust VR6 (the beep level) to set the courtesy tone and CW tone level.

VR3 is used to set the receiver audio mix level, and may not need to be adjusted from midpoint.

Programming the controller

The controller's programming is protected from unauthorized access by a four-digit secret passcode. The controller is programmed by eight-digit DTMF commands that all begin with the four-digit passcode. Throughout this manual, commands will be shown as *pppp*NNNN, where *pppp* represents the passcode, and NNNN is the actual command to the controller.

In order to save space in the microprocessor memory, the NHRC-4 repeater controller represents all numbers in "hexadecimal" notation. Hexadecimal, or "hex" for short, is a base-16 number format that allows an eight-bit number to be represented in two digits. Hex numbers are 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, and F. Converting decimal (the normal base-10 numbers that 10-fingered humans prefer) to hex is simple. Divide the decimal number by 16 to get the first hex digit (10=A, 11=B, 12=C, 13=D, 14=E, 15=F), the remainder is the second hex digit. For example, 60 decimal = 3 x 16 + 12 = 3C hex. Any decimal number from 0 to 255 may be represented in only two hex digits. Many scientific calculators can convert between these two number systems, and the Windows 95 calculator can, too, if the "scientific" view is selected. We provide a World Wide Web page that can generate all the programming data for the NHRC-4 controller quickly and easily: see [http://www.nhrc.net/nhrc4/nhrc4prog.html]. A 16-key DTMF pad has keys 0–9 and A–D, which map directly to their corresponding hex digits. Use the * key for digit E and the # key for digit F. A 16-key DTMF pad is required to program the controller. *(Note: All programming of the NHRC-4 must be transmitted to the radio attached to the primary radio port.)*

The controller will need to be initialized to allow you to set your secret passcode. Initializing the controller also resets all programmable settings to the initial defaults, including the CW ID message. It should not be necessary to initialize the controller again, unless you want to change the passcode. *The only way to change the passcode is to initialize the controller.*

To initialize the controller, remove power and install the initialize jumper (JP3). Apply power to the controller, and after a few seconds, remove the initialize jumper. The controller is now in the initialize mode. If you "kerchunk" the primary port's receiver now, it will send the default CW ID of "DE NHRC/4". Now transmit (into the primary receiver) your four-digit passcode. The controller will respond by sending "OK" in CW *once*. The controller will store the passcode and the main repeater will be enabled.

All programming is done by entering eight-digit DTMF sequences. The first four digits are the *passcode* chosen at initialization. The next two digits are an *address* or a *function code*. The last two digits are the *data* for address or function. To enter programming information, you must key your radio, enter the eight digits, then unkey. If the controller understands your sequence, it will respond with "OK" in CW. If there is an error in your sequence, but the passcode is good, the controller will respond with "NG". If the controller does not understand your command at all, it will not respond with anything other than a courtesy beep, and then only if the courtesy beep is enabled. If the controller is disabled, and an unrecognized command is entered, no response will be transmitted at all.

The NHRC-4 Repeater Controller provides several timers which control the operation of your repeater. The *Hang Timer* controls how long the repeater will continue to transmit after a received signal drops. This is often called the repeater's "tail." The tail is useful to eliminate annoying squelch crashes on users' radios. As long as a reply is transmitted before the hang timer expires, the repeater will not drop, which would cause a squelch crash in the users' radios.

The *Timeout Timer* controls the maximum duration of the retransmission of a received signal. It is more of a safety measure to protect the repeater from damage than a way to discourage long-winded users, even though it is often used that way. The NHRC-4 has a separate timeout timer for each port. The timeout timer(s) can be disabled by programming a 0 length.

Continued on page 32

DTMF Command	Address	Data	Description / Purpose
*pppp*2609	26	09	D
*pppp*2702	27	02	E
*pppp*2800	28	00	space
*pppp*2905	29	05	N
*pppp*2A3*	2A	3E	1
*pppp*2B0D	2B	0D	K
*pppp*2C09	2C	09	D
*pppp*2D0#	2D	0F	O
*pppp*2*29	2E	29	/
*pppp*2#0A	2F	0A	R
*pppp*30##	30	FF	end of message marker

***Table 1.** Programming the CW ID message "DE N1KDO/R."*

Build the NHRC-4

continued from page 31

The *ID Timer* sets the maximum duration between transmissions of the repeater's ID message(s). *(Note: The NHRC-4 may transmit an ID message before the timer expires in order to avoid transmitting the ID message while a user is transmitting.)* The timer values are stored as an eight-bit value which allows a range of 0 to 255. Some of the timers require high-resolution timing of short durations, and others require lower resolution timing of longer durations. Therefore, timers' values are scaled by either 1/10, 1, or 10 seconds, depending on the application.

To program a timer value, enter the four-digit passcode, the timer address, and the timer value, scaled appropriately. For example, to program the Hang Timer for 10 seconds, enter pppp0264, where pppp is your secret passcode, 02 is the hang timer address, and 64 is the hexadecimal value for 100, which would be 10.0 seconds.

CW messages are programmed by storing CW character codes into memory addresses. Select the memory address from the "memory map" table, and select the CW character code from the "Morse Code Character Encoding" table. For example, to program the CW ID message with "DE N1KDO/R," you would use the sequences shown in **Table 1**.

The CW ID can store a message of up to 20 characters. Do not exceed 20 characters. Be sure to include the end-of-message character (FF) at the end of each message.

Controller features can be enabled with the use of the configuration flag bits (see **Table 2**). These bits are encoded in a single byte, which is programmed into the controller at address 01. Multiple flag bits can be selected by adding their hex weights.

For example, to set up a controller with an audio delay on each port, and configure the digital output for fan control, you would add 02, 04, and 10 to produce hex 16, which you would then program into address 01 in the controller with this command: pppp0131. In addition to programming the flag bits as a group using address 01, the controller supports commands to set or clear these bits individually. Command 60 is used to clear (zero) a specified configuration bit, and command 61 is used to set (one) a specified configuration bit. For example, to set (turn on) bit 3 (to suppress DTMF muting), enter the following command: pppp6103. To clear bit 3 and enable the DTMF muting, enter this command: pppp6003. Note that the bit number, not its hex weight, is used for commands 60 and 61.

The five different courtesy tones are each individually programmable, and can be unique for each event, programmed to be the same as other events, or programmed empty to be silent. The NHRC-4 will play the appropriate courtesy tones 500 milliseconds (1/2 second) after a receiver drops. The courtesy tones all consist of four 100 millisecond (1/10 second) segments. Each segment can be no tone, low tone (a "boop," about 440 hertz), or high tone (a "beep," about 880 hertz). If all four segments are programmed as no tone, the courtesy tone will be disabled. Each segment is encoded as a dibit (pair of bits) where 00 is no tone, 01 is a beep, and 11 is a boop. The four segments are ordered into a byte, starting from the LSB. If this sounds confusing to you, then use the programming generator Web page to change the courtesy tones.

The radio ports can be disabled or enabled by remote control by setting the code for the operational mode in location 00. Program location 00 to 00 to completely disable the system. A value of 01 enables the primary repeater, 02 enables alert mode for the secondary port, 03 enables monitor mode for the second port, and 04 enables transmit mode for the secondary port.

We have found that the NHRC-4 controller suited our linking needs, and we hope you will find the controller project useful, too. We want to thank our wives—Danielle, Ruth, and Sharon—for putting up with us.

Partial kits, which include the printed circuit board, a programmed PIC16F84, an M8870 DTMF decoder, and printed assembly and operating manuals, are available from us for $39 plus $5.50 shipping and handling. Assembled and tested controllers are available for $149 plus $5.50 shipping and handling. Please contact NHRC Repeater Controllers, 444 Micol Road, Pembroke NH 03275; or see our Web site at [http://www.nhrc.net].

Bit	Hex Weight	Binary Value	Feature
0	01	00000001	secondary port is duplex repeater
1	02	00000010	audio delay on primary receiver
2	04	00000100	audio delay on secondary receiver
3	08	00001000	disable DTMF muting
4	10	00010000	digital output is fan control
5	20	00100000	reserved
6	40	01000000	reserved
7	80	10000000	reserved

Table 2. Configuration flag bits.

Number 33 on your Feedback card

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the December issue, we should receive it by Sept. 30. Provide a clear, concise summary of the essential details about your Special Event.

AUG 29

WESTON, WV The West Virginia State Radio Council will hold its 40th annual Hamfest and ARRL Convention August 29th at the Jackson's Mill State Conference Center in Weston, West Virginia. Flea market and tailgate spaces available. For more info contact *[wvsarc@qls.net]; or Patrick Shea N8MIN, Rt 4 Box 365F, Weston WV 26452.*

SEPT 5

CARP, ONTARIO, CANADA The Ottawa ARC (OARC), Inc., is pleased to announce its 2nd Annual Hamfest. The event will be held Saturday, Sept. 5th, 10 a.m.–1 p.m. on the Carp Agricultural Fair Grounds (at Falldown Lane) in Carp. Take Highway 417 to the Carp Road exit, north to the fairground. Tables are $10 each, plus admission; tailgate spaces $5 each, plus admission. General admission is $3. For info contact *Jim Cummings VE3XJ, (613) 446-1225; E-mail [fleamarket@oarc.net]*. Take a peek at *[http://oarc.net/fleamarket]* on the Web. The OARC Hamfest is held at the Carp Agricultural Fair Grounds at the same time as the Carp Farmer's Market, so an additional bonus is that guests can also enjoy stocking up on farm-fresh produce, and crafts from local artisans.

UNIONTOWN, PA Saturday, Sept. 5th, the Uniontown ARC will hold its 49th annual Gabfest at the club grounds located on Old Pittsburgh Rd., just north of the intersection of Rts. 51 and 119. Free parking and free tailgate space with registration. The event starts at 8 a.m. Talk-in is on 147.045(+) and 147.255(+). Table space available. For more info contact *Carl WA3HQK or Joyce KA3CUT Chuprinko, Rte. 6 Box 231-CC, Morgantown WV 26505. Tel. (304) 594-3779.*

SEPT 12

BALLSTON SPA, NY The Saratoga County R.A.C.E.S. Inc. will hold its 13th annual Hamfest on Saturday, Sept. 12th, at the Saratoga County Fairgrounds in Ballston Spa, New York, rain or shine, all under cover. Gates open at 7 a.m., with the hamfest running until 3 p.m. Admission is $4 (includes one tailgate spot and free parking). VE exams and a foxhunt will round out the program. Reserved tables $5 each, first come, first served. Reservations and prepayment welcome and encouraged. Early setup for all vendors. For reservations and further info, contact *Darlene Lake N2XQG, 84 Wilton Mobile Park, Saratoga Springs NY 12866; (518) 587-2384; packet [n2xqg@wa2umx]; or E-mail [lake@capital.net]*. Talk-in on 146.40/147.00 and 147.84/.24.

SEPT 19

WARROAD, MN The Lake of The Woods Repeater Assn. Inc. will host a hamfest at Warroad Area Community Center, 222 Virginia Ave. NE, Warroad, Minnesota. Handicapped accessible. Setup is at 10:30 a.m.; open to the public starting at 1 p.m., with a banquet and program being presented starting at 5 p.m. The banquet is limited to 100 plates; reservations are suggested. VE exams at 11 a.m., walk-ins OK. Bring original and photocopy of current license, photo ID, and a check for the fee of $6.35 (testing for Novice class is free). Talk-in on 147.090(+) and 147.00(-). Admission to the hamfest and banquet $12; hamfest only, $5. Seminars and an ARRL display will be featured. If reserved in advance, dealer and flea market tables are no charge with paid admission. Send check and table reservation to *David Landby KBØHAP, Rt. 3, Box 10, Warroad MN 56763. Tel. (218) 386-1092.* Pick up tickets and table numbers at the door. If you arrive early, please join the sponsors for a 9 a.m. breakfast at the Patch Restaurant, Highway #11 W, Warroad.

SEPT 20

CAMBRIDGE, MA A Tailgate Electronics, Computer and Amateur Radio Flea Market will be held (rain or shine) Sunday, Sept. 20th, 1998, 9 a.m.–2 p.m. at Albany and Main St., Cambridge, Massachusetts. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance—includes one admission. Setup at 7 a.m. For space reservations or further info, call *(617) 253-3776.* Mail advance reservations before the 5th to *W1GSL, P.O. Box 397082 MIT BR, Cambridge MA 02139-7082.* Covered tailgate area available for all sellers. Talk-in on 146.52 and 449.725/444.725 pl 2A W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

MT. CLEMENS, MI The L'Anse Creuse ARC will host an event at L'Anse Creuse High School. Exit 236 off I-94 onto Eastbound Metro Pkwy. (16 Mile Rd.), left (N) on Crocker Blvd., right (E) onto Reimold to the last of three school buildings. Free parking. Swap 'n' shop, new and used amateur radio equipment, antique radios, electronics, computers, software, trunk sales ($5 per space), vendors. Admission $4 in advance, $5 at the door. 8 ft tables $6. Send SASE to *Richard Dzick N8MQU, Box 180072, Utica MI 48318-0072. Tel. (810) 268-4671, or E-mail [n8mqu@aol.com].* VE exams at 9 a.m. For registration and more info call *Don Olszewski WA8IZV, (810) 294-1567.* Talk-in on 147.08(+), 146.52.

Continued on page 34

NEWTOWN, CT The Western CT Hamfest will be held at the Edmond Town Hall, Rt. 6, 9 a.m.–2 p.m. Setup is at 7 a.m. Exit 10 on I-84. Talk-in on 147.12/.72. New equipment dealers, flea market, tailgating, and computers, will be featured. Tables $10, tailgating $6 (each includes 1 admission). Admission is $4, under 12 admitted free. Contact *Ken Weith KD1DD, P.O. Box 3441, Danbury CT 06813-3441. Tel. (203) 743-9181.*

YORK, PA The Hilltop Transmitting Society, Keystone VHF Club, and York Amateur Radio Club are joining together to sponsor a hamfest at York County Area Vocational Technical School, 500 yards off I-83, Exit 6E. Admission $5. Tailgating is $3 with paid admission. Indoor tables (advance sale) are $15 ea. Free VE exams onsite. QRP and ATV seminars will be featured at this event. Talk-in is on 146.97. Take a peek at the Web site *[http://www.yorkhamfest.org]* for more info. E-mail *[w3sst@juno.com]*, or write to *York Hamfest, P.O. Box 351, Dover PA 17315. Tel. (717) 764-8193.*

SEPT 26

DAYTONA BEACH, FL The ERARA and DBARA clubs have again joined together to sponsor a special day of bargains and fun at the Embry Riddle Aeronautical University campus, located just two miles from the heart of Daytona's shopping center. The XYL and children can shop or visit the world's most famous beach, which is just 20 minutes away. The hamfest will be on the Embry-Riddle Campus, located on Clyde Morris Blvd., just south of International Speedway (US 92). Talk-in on 147.150(+600) starting at 8:30 a.m. Admission is $5. For advance tickets send check or money order along with an SASE to DBARA-HAM*FEST, P.O. Box 9852, Daytona Beach FL 32120-9852*, before Sept. 10th. E-mail *[munseyj@worldnet.att.net]*; Web page at *[http://www.america.com/~dbara/]*. This is an indoor air-conditioned event with acres of paved parking. Handicap parking is provided. Paved tailgate area, too. VE exams, all classes. There will also be a T-hunt with a $50 cash prize.

HAMILTON TWP., NJ The Tall Cedars of Lebanon picnic grove on Sawmill Rd., in Hamilton Twp., New Jersey, is the location for a hamfest being sponsored by the Delaware Valley Radio Assn. Directions: I-95 North to I-295 South; exit 60A to I-195 East; Exit 2 to Yardville; South Broad St. to end, approx 3.7 miles; left at Yield; next right onto Sawmill Rd.; the site is 1.1 miles on the right. Open to buyers at 8 a.m. Open to sellers at 6:30 a.m. Admission $5. Non-ham spouses and children admitted free. Free parking. ARRL table. Tailgating space $10, includes one admission. Covered table space $15, includes one table and one admission, some electricity. Advance covered space reservations available. Talk-in on 146.67(-) For more info contact *Hamcomp '98, DVRA, P.O. Box 7024, West Trenton NJ 08628. Tel. (609) 882-2240;* or punch in *[www.slac.com/w2zq]* on your computer.

HORSEHEADS, NY The Amateur Radio Assn. of the Southern Tier, Inc. will present its 23rd Annual Elmira International Hamfest-Computerfest on Saturday, Sept. 26th, at the Chemung County Fairgrounds in Horseheads, New York. Talk-in will be on 147.96/.36 or 444.20 ARAST rptr. There will be dealer displays of new equipment, and a large flea market area. Breakfast and lunch will be served on the premises. Admission is $4 for advance tickets, $5 at the gate. The event will run from 6 a.m.–3 p.m., with a pancake breakfast at 6 a.m. VE exams start at 9 a.m. on the grounds; walk-ins accepted. Dealers please contact *Gary at (607) 739-0134*. For ticket inquiries, call *Dave at (607) 589-7495*. For more info about VE exams, call *John, (607) 565-4020.* RVs and trailers coming in Sat. a.m. and going out Sat. p.m., no charge. Campers in on Friday, $15 hookup, $10 no hookup. Pay at the gate Friday. Gates closed midnight Friday to 5 a.m. Sat. There is plenty of free parking for hamfest attendees, and the flea market is free (ham and electronic gear preferred). Make checks payable to *Amateur Radio Assn. of the Southern Tier, Inc. (ARAST)*. Mail with an SASE to *Elmira Hamfest, c/o Dave Lewis, 465, CR 13, Van Etten NY 14889.*

SEPT 26–27

LANCASTER, NH The Moose Swappers Hamfest & Computer Fleamarket will be held at the Lancaster Fairgrounds on Route 3 just north of the center of Lancaster, New Hampshire. Features include onsite parking, over 200 hookups in the selling area, and a very large commercial vendor space at low rates or free. Miles of tailgating space at 12 feet per ticket. No tickets will be sold at the gate Friday night. Admission $9 in advance or $10 at the gate. Sunday at the gate, $5 per person. Saturday special, $20 per carload at the gate. Camping space with hookup $50 for both Friday and Saturday nights on the grounds. Gates open at 6 p.m. Friday for advanced registered ticket holders only. Saturday the gates open at 5 a.m. There is plenty of parking and camping space across from the fairgrounds for those arriving Friday without advance tickets. No waiting in line at the gate before the gates open. VE exams will be held Saturday and Sunday mornings. This hamfest was organized by *Russ N1YZE at (603) 922-5514, E-mail [cusvt@together.net], and Bob WA1DPP at (603) 838-6469, E-mail [howies@together.net]*. Proceeds above operating costs go to benefit the United Way.

MILTON-FREEWATER, OR The W7DP Hamfest will be held at the Community Building, 505 Ward St., in Milton-Freewater, Oregon. Open 8 a.m.–4 p.m. Saturday, and 8:00 a.m.–10 a.m. Sunday. Setup 6 p.m.–8 p.m. Friday and 7 a.m.–8 a.m. Saturday. Admission $5 per person with under 16 years old admitted free. Tables available for $10 each. Talk-in on 147.28(+) MHz, the Blue Mountain rptr. Contact *Denise Hebel KC7ORO. (509) 527-0411; E-mail [dhebel@bmi.net]*. Mail prepayments with an SASE to *W7DP, P.O. Box 321, Walla Walla WA 99362.*

SEPT 27

NEW PORT RICHEY, FL The Suncoast ARC will sponsor the 8th annual Pasco County Hamfest & Computer Show, Sunday, Sept. 27th, 9 a.m.–3:30 p.m., at the New Port Richey Recreation Center. Take US 19 to Main St. in New Port Richey, east 1.5 mile and left (north) on Van Buren. The Recreational Center is on the east side 1/2 mile north of Main. The event will be inside, and air conditioned, with outside tailgating. General admission $5, under 12 years old free. Tables $15 (includes chair, table and admission for one; electric $5 extra). 125 tables. We sell out by Sept. 1, so get your table ASAP. There will be computer dealers in attendance with a full line of computers, CDs, and software at rock-bottom prices. For more info contact *Chuck KU4EV, (813) 937-2540 or E-mail at [cfowler995@aol.com]*. Talk-in on 145.35 and 147.15 rptrs.

SPRINGFIELD, OH The 1998 Independent Radio Assn. Hamfest will be held at the Clark County Fairgrounds, 1/4 mile north of I-70 Exit 59 on State Route 41. Hours are 8 a.m.–3 p.m., with vendor setup on Saturday, 6 p.m.–10 p.m., and Sunday 6 a.m.–8 a.m. Admission is $5 for adults, children 12 or younger admitted free. Free parking. The event is all indoors and handicapped accessible. Talk-in on 145.45/144.85. Outdoor sales are not permitted. For vendor or general info, leave a message at *(937) 325-3047*, or write to *Independent Radio Assn., P.O. Box 523, Springfield OH 45501.*

OCT 4

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens, New York. Doors open for vendors to set up at 7:30 a.m., buyers admitted at 9 a.m. Free parking. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr. pl 136.5. For further info call nights only. *Stephen Greenbaum WB2KDG, (718) 898-5599; or E-mail [WB2KDG@bigfoot.com].*

OCT 10–11

TAMPA, FL The Egypt Temple ARA will host their 2nd annual Hamfest and Computer Show in the Unit Building located at 4050 Dana Shores Drive, Tampa, Florida. There will be 60 tables for sale at $15 each for the two-day event, 18 of which will be against

the wall with standing room behind and aisle space in front. Each table will have two chairs. Admission tickets required by all except children under 10 years of age. Electricity will be available but customers must supply their own cable. Table reservations and tickets can be obtained from *J.F. Strom K9BSL, 233-34th Avenue North, St. Petersburg FL 33704-2241. Tel. (813) 822-9107.* No food or drink allowed except that being sold by Egypt Temple members.

OCT 24–25

EL PASO, TX The ham operators of West Texas, Mexico, and New Mexico are banding together to produce an all new 1998 Southwest International HamFiesta which will be held on the 24th and 25th of October. Commercial setup on Friday afternoon and evening. Hours are from 8 a.m.–5 p.m. Saturday, and 8 a.m.–2 p.m. Sunday. Indoor table space available at $10 per table (for both days) before Oct. 1st, or $12 after Oct. 1st. Please try to arrange for your table space early. Visit the Web site at *[www.hamfiesta@dzn.com]* for more details, or mail inquiries to *Hamfiesta, P.O. Box 971072, El Paso TX 79997-1072. Tel. (915) 859-5502.*

SPECIAL EVENT STATIONS

AUG 24–SEPT 7

SYRACUSE, NY The Liverpool NY Amateur Repeater Assn. Special Event Station, W2CM, will be on the air 10 a.m.–9 p.m. from the Railroad Caboose, rear of the New York State Fairgrounds, near the grandstand. Listen on 10–80 meters SSB and CW. For more info contact *Dick Page AC1M.* For an award send a large SASE to *Dick Page AC1M, 2939 Lafayette Rd., Lafayette NY 13084 USA.*

SEPT 5

NOTRE DAME, IN Notre Dame ARC will operate ND1U 1600Z–2359Z Sept. 5th, to commemorate the 100th Anniversary of the First North American Wireless Transmission. SSB: 7.250 and 14.250. CW: 7.035 and 14.035. To obtain a commemorative QSL, send an SASE to *Notre Dame Amateur Radio Club, 226 COBA, University of Notre Dame. Notre Dame IN 46556 USA.*

UNIONTOWN, PA The Uniontown PA ARC (W3PIE) will operate the club station on 147.045–3.95 00:00–03:00 and 147.045–7.25–14.3 12:00–18:00 to commemorate the 60th Anniversary of the founding of UARC. For QSL, submit SASE for a certificate to *UARC Inc., 465B Old Pittsburgh Rd., Uniontown PA 15401 USA.*

SEPT 6

PANAMA, THE REPUBLIC OF PANAMA The Radio Club de Panama will celebrate its 27th Anniversary with an HF Contest. The contest will be on the 15, 20 and 40 meter bands, single operator phone only, and will operate 00:01 UTC–24:00 UTC. Contacts between all radio hams, worldwide, are valid. For more details, E-mail *[hp1cdw@supremepty.com] or [suman@supremepty.com]. By packet. [HP1BYS@HP1CDW.PANCTY.PAN.CEAM] or [HP1BSL@HP1BSL.PANCTY.PA.CA]. Fax HP1BYS at (507) 260-9020, or HP1ECA at (507) 261-7277.* Logs must be stamped with a mailing date not later than Nov. 30th, 1998. Send to *Radio Club of Panama, Contest, P.O. Box 10745, Panama #4, Republic of Panama.*

THOMSON, IL The Palisades ARC and 90 West DX Assn. will operate W9BPT, Sunday Sept. 6th. 1700Z–2100Z, to celebrate Thomson Melon Days. Operation will be on the lower portion of the General 40 and 20 meter bands. For a certificate, send QSL and a 9" x 12" SASE to *Bob Plumley K9IEG, 1123 West Main St., Thomson IL 61285 USA.*

SEPT 11

MORRISONVILLE, NY The CVARC of Morrisonville, New York, will operate W2UXC to commemorate the US victory over the British in the Battle of Plattsburgh, Sept. 11, 1814, during the War of 1812. Operation will be Sept 12th and 13th, 1300Z–1800Z on 7.260 MHz and 14.260 MHz. For a QSL, send an SASE to *CVARC, P.O. Box 313, Morrisonville NY 12962 USA.*

SEPT 12–13

VERVIERS, BELGIUM The G.D.V. "Gang de Verviers" of Verviers, Belgium, will again operate ON4USA, 1100 UTC–1700 UTC, Sept. 12–13. The operation will originate from the Henri-Chapelle Cemetery, Belgium, and all radio operators are encouraged to participate. Station ON4USA was formed in 1988 by Mr. Christian Keldenich in gratitude for their freedom, which was gained more than 50 years ago. The station continues to operate on a yearly basis and many of the participating hams are bilingual, so language will not be a major problem. This event is conducted to honor the memory of those who gave their lives between 1939 and 1945 for the freedom of Europe, and to celebrate the liberation of the area around Verviers, Aubel, Welkenraedt, Hombourg and Henri-Chapelle, Sept. 9–12, 1944. CW—7.040, 14.040, and 21.040. SSB—14.225, 21.275, and 28.475.

SEPT 14–19

ATLANTIC CITY, NJ Southern Counties ARA will operate K2BR Sept. 14th at 10 a.m. (1400 UTC)–Sept. 19th at 11 p.m. (Sept. 20, 0300 UTC) from the Miss America Pageant in Atlantic City, New Jersey. Atlantic City is located on Absecon Island, IOTA NA111. Suggested frequencies in MHz for 10, 15, 20 and 40 meters: Phone—28.325, 21.325, 14.250, 7.250. CW—28.065, 21.090, 14.090, 7.090. QSL with a #10 SASE to *SCARA, P.O. Box 121, Linwood NJ 08221 USA.*

SEPT 19–20

HONOLULU, HI The Razorback Radio Club, K5HOG, is sponsoring the 1998 Air Force Anniversary QSO Party and is trying to reach as many Air Force veterans and members as they can. The purpose of this annual event is to gather on the air as many active and former members of the Air Force as possible for a weekend of fellowship in remembrance of all those who served. For rules please E-mail *[k5hog@aol.com] or [k5xs@compuserve.com]*, or write to *The Razorback Radio Club, 604 Julian Avenue, Honolulu HI 96818 USA.* Remember to send a business-size SASE.

SEPT 27–28

WANAQUE, NJ The Classic Radio Exchange (CX) is a contest celebrating the older commercial and home-brew equipment that was the pride of our ham shacks and bands just a few short decades ago. The object is to encourage restoration, operation and enjoyment of this older equipment. A "Classic" radio is at least 10 years old (age figured from first year of manufacture), but is *not* required to participate in the Classic Exchange. You may use anything in the contest, although new gear is a distinct scoring liability. The Classic Exchange will run from 1900 UTC September 27th–0400 UTC September 28th. Exchange your name, RST, QTH, receiver and transmitter type (home-brew send final amp tube or transistor), and other interesting conversation. Suggested frequencies are CW—3.545, 7.045, 14.045, 21.135, 28.180. Novice/Tech Plus—3.695, 7.120, 21.135, 28.180. Phone—3.880, 7.290, 14.280, 21.380, 28.320. 7.045 and 3.545 will probably be the most popular CX frequencies. For details regarding scoring, etc., contact *Howard Holden WB2AWQ at (973) 839-6086 after 6 p.m. Eastern Time, or [holden@uscom.com].* Send logs, comments, anecdotes, and pictures to *Allan Stephens, 106 Bobolink Dr., Richmond KY 40475.* Include two-stamp SASE for the next CX Newsletter and announcement of next CX. E-mail reports may be sent to Al N5AIT at *[modsteph@acs.eku.edu].* 73

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

VHF to microwave: how to repair old beam antennas

What started out as a winter storm here in San Diego became a severe path of destruction to my amateur-related activities and antenna system. High winds associated with the storm snapped my antenna guy wires and toppled my antenna. That was the start of all the fuss to reconstruct what had been my modest antenna system for VHF.

Evaluating the initial damage was a little hard, as the mast collapse (because of the snapped guy wire) could have been prevented by some simple maintenance. I had apparently left the system in the air for too long, without providing some care and upgrading or replacement of worn parts.

Time had made me complacent in the maintenance of my antenna system. I had not given any attention to a problem which had been waiting to happen for some time. In hindsight, we all should take time to give our systems some attention, to prevent having to replace antennas in a similar fashion.

The main culprit in my failure was the guy wires I had used. Through time they had become weak from stretching and just plain age. A simple bend showed that the material had become less malleable than new material. That should have been a great clue but it went unnoticed. All the signs were observed when the antennas were lying on top of my roof—after the system's key guy wire had broken in the high wind.

At least the roof wasn't damaged when the system came down that stormy evening. Nothing was done at the time, because we determined that no further damage could be done as long as the antennas were resting firmly on top of my roof that Friday evening. Saturday morning would tell the full tale.

I am describing this adventure in reconstruction to show the efforts I went through in an attempt to be cost-effective in making the repairs to the old existing antennas, twisted as they were. First, the careful job of removing the pile of antennas and cable and getting down to business.

On first evaluation, the two-meter and six-meter beam antennas took the worst of the storm's fury. Actually, the six-meter beam boom stopped the entire structure from becoming a tangled mass of scrap aluminum because the long boom end hit the roof and stopped the remaining antennas from becoming an intertwined mess of metal.

All was not well, as the toppling over was done in an 80-or-so mph high wind gust. It just twisted the mast after the guy snapped.

When the antennas came to rest on the end of the six-meter boom there must have been quite a shock to all of their basic structures. The gamma match of the six-meter beam shattered into a number of pieces, as did several elements of the six- and two-meter beam antennas. The RG-58 coax feeding one antenna parted, but the RG-8 (RG-213) coax held together and was at full strain holding the antenna, which was now bent over on the roof. In a way, it became part of the guy system when it went over.

Reconstruction of the system started with cutting the RG-8 coax and getting rid of old cables that were in the way. They had been in the air for many years and showed signs of age on the outer jacket. Most bolts holding the antennas were rusted beyond use and, while some came off with a little oil and elbow grease, quite a few had to be twisted off until they broke. First lesson: Spend the extra cash and use stainless or galvanized hardware on your antenna. They will not rust like common cad-plated nuts and bolts. You will thank me when you have to work on your antenna in a less hostile environment.

Removal of the beam antennas was next, placing what was left of the two- and 3/4-meter yagi antennas on the roof, off of the mast.

The last main structure to be removed was the six-meter beam. The original mast structure was removed and replaced with a new mast for the day when the antennas would go back up. Now the quandary was whether to purchase new antennas or repair the old. Taking stock, I determined that I could purchase new aluminum tubing for the six- and two-meter beam elements and (galvanized) hardware to reattach them for about $12.

The trick to pull off was how to reconstruct the gamma match of both the two- and six-meter feeds. The original gamma match systems were constructed with some sort of plastic and two sections of aluminum tubing forming a capacitor of sorts for the feed. See **Fig. 1.** How to repair this gamma match for these two bands remained to be solved. Would it be better to purchase new antennas or repair the existing? I examined the coax cable and the answer became very clear.

The coax cable was years past due for replacement. I confirmed this by testing the loss of a 50-foot section of RG-213 that had been up for a lot of years. I made a test on a new piece of RG-213 and found that the loss of the old piece was about 1.5 dB greater, compared foot for foot. The old cable had to be replaced. Purchasing new cable would be expensive. I checked the loss tables and found that Belden 9913 might be the best from the cost-to-low-loss standpoint. Expensive, but well worth it.

At two meters, the loss of Belden 9913 was one half the loss of brand new RG-213 (RG-8 quality coax). The 9913 specs at 1.5 dB and the 213 at 3 dB at 150 MHz. At 450 MHz, the Belden 9913 really shines, as its loss is 2.6 dB versus 6 dB for RG-8 types. This is a no-brainer decision—purchase the Belden 9913. Because the 9913 is a hard line type of coax, mating it to a gamma match requires that it be brought out to terminal lugs to bolt to the gamma match sections.

The #12 solid conductor of the 9913 cable was a slight problem because it has a spiral-wrapped internal construction that provides low loss but also allows water to enter at the coax end if not properly sealed. I solved this problem by crimping on my bolt connectors and then sealing the end of the open coax inner section with a small dab of RTV. I then overwrapped the center section and braid with good quality electrical tape, making many twists, figure-eights, and crossed-over tape sections to add additional protection from the weather.

Someone suggested the I apply a layer of varnish or plastic spray to cover the tape. On the advice of Kerry N6IZW, we tried some plastic sprinkler pipe glue and overcoated the tape with the plastic cement. This seemed to be best, as it really made what seemed to me to be a bond with the electrical tape and the jacket of the 9913 coax cable. This looked to me to be the best method of sealing the Belden 9913. Additionally, when I mounted the cable on the gamma match I positioned the cable on top and ran the crimp-on connections on down, forming a sort of drip loop preventing moisture from easily entering the coax cable. See **Fig. 2.**

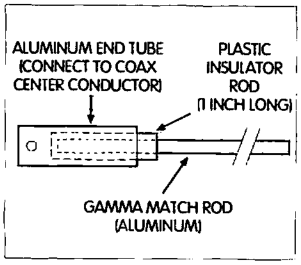


Fig. 1. Basic yagi gamma matching design typical of most commercial designs using plastic matching capacitor.

Now that my main expenditure was going for new Belden 9913 coax to replace my old lossy cable, the idea of a couple of new $150 beam antennas for two and six meters would be scrapped and the old antennas repaired. With $12 allocated for replacement element parts, the problem now remaining was how to repair the gamma matching scheme on the existing beam antennas.

Looking through various antenna handbooks and other literature, I found a simple rule stating that the gamma capacitor should be about 170 pF at 14 MHz and then scaled proportionally for other frequencies. Some simple math meant that at double the frequency, the capacitor value would be halved (28 MHz = 85 pF, 56 MHz = 42 pF, making a two-meter capacitor somewhere in the 10 pF range).

I reconstructed my six-meter gamma match by soldering a 37 pF glass piston capacitor onto short sections of brass tubing that fit over the piston capacitor and would fit over the old aluminum gamma match adjustment arm. The end by the connection to the insulator and center of the coax attachment was flattened and drilled to accept a #8 stainless bolt. The other end of the capacitor brass extension tube was slipped over the gamma arm and drilled to be secured with a 4-40 stainless bolt and nut. This attached the brass and aluminum rod firmly together, making a good electrical connection. With max capacitance at 37 pF, the brass sleeves were then overlaped and coated with plastic cement. See **Fig. 3.**

This worked amazingly well, but it soon became evident that the construction was not sturdy enough for the application. The glass piston capacitor and associated rebuilt gamma arm worked very well and was easy to adjust to resonance on the six-meter beam. However, this arrangement was not as good as I thought because I cracked three glass piston capacitors before I gave up on the idea.

In actuality everything worked well, but the glass piston capacitor I used was not sturdy enough. Looking through my junk box, I found several doorknob-type high voltage ceramic capacitors in the 25 and 100 pF range. These are the ones that have for the center connection a brass 6-32 screw mounting shaft.

I tried to insert the capacitors into the brass tubing I used with the earlier piston capacitors, and had to file off the edges. Then I soldered the capacitor onto the brass tubing sections and confirmed that while the value of capacitance was a little low, this worked quite well. The hammer test with a screwdriver proved the assembly to be quite rugged (see **Fig. 4**).

Because the assembly used a gamma capacitor of 25 pF, the gamma matching arm had to be set at maximum to bring the section into resonance at 50 MHz for a great SWR of 1:1 or quite near it. As the test was made on the ground, there were, I am sure, stray effects showing up—but it worked well.

Just as with the glass piston capacitor, 37 to 40 pF would be the ideal capacitance desired for the ceramic high voltage capacitor as well. Junk boxes being what they are, I don't believe you or I will find a 40 pF capacitor. I had to settle on a 50 pF one and use it on the final gamma matching arm I constructed for the six-meter beam. The total cost of reconstruction for the gamma match was 50 cents and about five hours of elbow grease.

Oh, I forgot: There was that pint of gas to travel to K6DS's QTH to pick up the 50 pF ceramic capacitor that I used. I put the 50 pF unit on the antenna, confirmed a greater adjustment range over frequency, and then left it on for a final match when the antenna is up on the mast in the air.

For all these tests, I have attributed the ease with which I was able to make them to my MFJ-259 antenna analyzer SWR meter. Makes the evaluation and adjustment of antennas in the 2 to 150 MHz range quite easy.

Well, as you suspect, all the coax cables are cut to length and crimp connected in place, overwrapped, and sealed with connectors on the appropriate ends. What else remains to be done? In my case, it's mostly metalwork, making gusset plates to mount the boom to the two-inch mast section.

Here comes the hard part. I had to settle for less than I'd planned, as I could not find galvanized two-inch muffler U-bolts with back plates to fasten securely to the mast. I had to compromise with (untested) standard muffler clamps. These arrived as black steel and I am not sure how they will stand up to the weather.

I manufactured my mounting plates from four muffler clamps to secure the beam antennas to the two-inch main mast. It resulted in a very sturdy mounting arrangement, and was constructed out of scrap aluminum old panel sections that came out of the old junk box. I picked up the muffler clamps at a muffler repair shop. They came with the round-to-flat adapter clamp plate so necessary for securing the round tube of the boom and mast sections tightly.

The muffler-type clamps are probably available from some hardware source, but I was unable to locate them and settled for the muffler shop clamps. The cost was minimal for the clamps: one dollar for the two-inch ones, and less for smaller clamps. Quite reasonable. I lubed mine with a little grease and slipped an SMA coax protector cover over the bolt ends to protect them from rusting. Can't have everything, but you can prepare for the future.

I hope you have gotten some ideas on antenna reconstruction from my sad tale of the destruction that occurred on that Friday evening when things went "bump in the night." 73, Chuck WB6IGP.

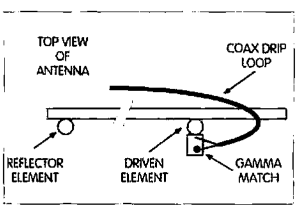


Fig. 2. Drip loop allowing rain to roll off the coax end termination by having the open end sealed and pointing down so it will not collect moisture.

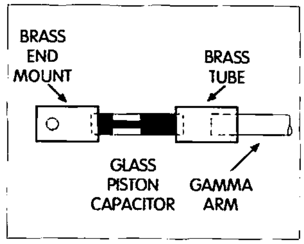


Fig. 3. The first attempt at constructing the gamma match section with a glass piston capacitor soldered to small sections of brass tubing for connections to the mounting insulator and gamma aluminum rod.

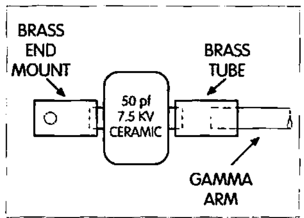


Fig. 4. Final gamma match capacitor construction using a 50 pF ceramic high voltage capacitor attached to brass tubing. Near end swaged for nut and bolt attachment and the other end inserted into the original aluminum gamma match arm. Attached with a 4-40 bolt through both brass and aluminum rod.

continued from page 5

who as the Hudson Division director was secretly controlling the ARRL. He was abetted by Bill Eitel W6EI, the head of Eitel-McCullough (the tube manufacturer) and his lackey Bill Orr W6SAI.

By publishing hundreds of repeater and two-meter FM articles in *73*, plus starting a magazine (*The Repeater Bulletin*) devoted to repeaters, publishing one book after another on the subject, and organizing repeater conferences around the country, we helped repeaters emerge as the most active aspect of the hobby. It was our repeater developments that made it possible for Motorola to launch the cellular telephone industry.

It was my success in helping to change the world just a tad with repeaters that got me to see if I could do it again when the first microcomputer was announced in 1975. In addition to starting the first magazines in this new field, I also organized the first industry standards conference. I picked Kansas City for the conference because it was equally far for all of the companies to travel. That's how the Kansas City Standard for data storage came about.

Yes, you can help change the world, possibly for the better. I helped with cell phones, personal computers and in several ways with compact discs. And I'm just a guy up here in New Hampshire. I'm a guy who takes advantage of serendipity instead of ignoring it.

It was serendipity that got me to be one of the founders and the first secretary of American Mensa. Two of the other founders never did anything further and the third moved to Switzerland and dropped out. And I did that even though I was up to here in starting *73 Magazine* at the time, as well as being president of the Porsche Club and deeply involved with the Hudson Division ARRL Convention.

The year before had been busy for me, with a ham tour of Scandinavia in the spring, an around-the-world flight operating on 20 meters and stopping at around 26 countries during the summer, and representing the US as a delegate to the International Telecommunications Conference in Geneva in the fall. These were all exciting, but didn't contribute much to moving the world ahead — though many of the things I learned on the trip formed the basis for my later influence on the development of Jordan.

Serendipity (the gods? angels?) will offer you opportunities, too. Grab them.

Your Influence

I've written about this many times, but you've just pooh-poohed it. You *can* make things happen. A recent Art Bell guest explained how anyone (including you) can cause clouds to reshape themselves. He said to pick a calm day with a few light clouds and then concentrate on one particular cloud, willing a hole to open in it. When the hole does open you're going to get a whiff of a whole new world of understanding dawning for you. You *can* influence matter. And people. And the future. You are not a prisoner in the slave gang of life with God calling all the shots. You *can* help make your luck. You can also, just by believing it, make your own bad luck. If you are a negative person, you are going to continually have negative experiences. *You* are causing them.

I try to reach out to those willing to think in my editorials and books, but I know I'm up against thoroughly ingrained brainwashing from your parents, teachers, friends, and the media, so even tiny successes are a wonder. Can I get the ball rolling by getting a few readers to think? Hoping they (you) will, in turn, pass along my message?

Yes, you can influence a cloud. Yes, you can communicate with animals and plants. Yes, your cells are in communication with the whole of your body. Yes, there is a God, but there's no evidence that He is a vengeful God, or that what you say or think about Him will in any way change His love. Those are human problems.

Read, learn, and stop being screwed by people and organizations who want to take advantage of your ignorance and gullibility.

Yes, college is necessary if you've decided you want to be a teacher or to work for a large company all your life — or to work for the government. But for most entrepreneurs it's a ghastly waste of time and money.

Coda

Yeah, stop bitching about my being a broken record. I'll shut up when you start getting hamfest committees to put me on the program and you're busy hugging me for my part in changing your life. You can also keep me too busy with interviews on radio talk shows if you tell 'em about me.

Emergencies

A note from Robert Jerome N8PTI of Saginaw, Michigan, says that in his recruiting for the Amateur Radio Emergency Service (ARES) he's getting only Tech licensees volunteering. The older hams tell him, "We did it, let someone else do the public service."

Sigh.

It's lucky I'm not in Robert's place. I'd say: Look here, you fat old curmudgeons, name one thing that you are doing to pay back the public for the billions of dollars of radio frequencies which you're being permitted to use. You are no longer providing any trained operators or technicians in case of war. You haven't for years done anything to advance the state of the communications art. You can't even fix your own equipment when it breaks, much less design or build anything. A few of you still can use the Morse Code, which is about as useful for military or commercial communications today as a knowledge of smoke signals. Its *only* use today is as entertainment.

The Japanese Meltdown

A prophet should have a more immediate medium than a monthly magazine. I guess I'll have to pay more attention to the Internet. Anyway, I'm writing this in late June as I'm reading about how the Japanese yen is being supported by us. Well, I don't have to go very far out on a limb to predict that the Japanese banking industry is heading for a total collapse. And that's going to take the rest of Asia along with it.

The basic problem is simple. As has happened here in America, the Japanese banks bought each other out, ending up with a handful of huge banks. In the process the real estate loans on property (which was enormously overvalued) left the banks with very little in the way of assets. Any demand for cash would collapse the whole system.

Worse, over a trillion dollars of the bank loans were made to *Yakuza*-owned (the Japanese version of the Mafia) and mostly worthless companies. These are loans which will never be repaid.

To date, the Japanese government, not having any solution to the situation, has been mostly wringing its hands. No attempts have been made to eliminate the basic problems. So any money we or the IMF throws into the mess is money lost. If any of it does get to a bank, the *Yakuza* will grab it first.

Then There Are Our Banks

I'll bet you haven't noticed that the American banking system has, just in the last few years, consolidated to maybe five or six huge banks. And do you know that they're all foreign-owned? That reminds me of what I found when I got involved with the music industry. I discovered that 96% of all record sales in America were being made by just six music megacorporations, five of which were foreign-owned. And they were making damned sure that no independent music company

Number 39 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

All modems aren't created equal. You may recall the serial modem I described in the February column that worked so well for RTTY and SSTV—plus it is so reasonable to build. There are others out there, many are similar, and they all function and are fun to use. This month I want to tell you about a modem that isn't just another plain-Jane black box, but is a top-drawer piece of equipment replete with bells and whistles I didn't know existed.

I received the Timewave DSP-599zx with the new DSP-RTTY program and was nearly overwhelmed with the claims made in the accompanying manual. A whole new world of ham digital electronics must have been stuffed in a very small box.

The proper order of approach for me was first to learn what the DSP-599zx hardware could do on its own before using the internal modem. There have been reviews of this unit previously, so I will merely give you a few of my first impressions.

Upon opening the manual, you find a section that explains how to see it work for SSB and CW with just a few quick cable hookups. I did that and determined that the device worked. Those two modes weren't what I was after, but the unit definitely cleaned up signals without adding ringing noises as my old standby, the Autek QF-1A, is prone to do.

The next step was to see how this worked in conjunction with the AEA PK232. The difference is fantastic. The hookup was simple enough, using the information supplied with manuals from Timewave, ICOM for the IC-735, and AEA for the PK232.

The excitement began

Timewave knows their stuff when they recommend plugging external stereo speakers into the filtered output of their unit. I have been certain for years that you and I come equipped with a marvelous listening system that we can train to pick out a signal from a jumble of noises and then mentally tune to. We can even set our attention on one CW signal and copy it with real discipline.

However, that works only somewhat for SSB and we can only do this with CW for a few minutes before our minds rebel. And all this discipline is to no avail with RTTY, PACTOR, SSTV, or any other such mode because the ordinary demodulating system can't train itself to listen to just one set of tones while rejecting the others.

That was true before DSP came to rest in the shack. The difference is so remarkable that you simply have to be there to believe it. Since the order of the day is going to be a discussion on RTTY, I will tell my experiences using the DSP-599zx in front of the PK232.

The PK232 has long been a standard of the industry and I have had this one for most of that era. Since the entry of DSP into ham radio technology, I had wondered just how well it would enhance copy. I had listened to a few signals on radios with

Continued on page 40

---

could survive for long by spending about $100 million a year to bribe the music directors of radio stations to *not* play independent music.

I also found that 98% of the performers on these major labels were never making a nickel on royalties. This was confirmed in a *Forbes* article, so this isn't just rhetoric.

We used to have a bunch of banks around this part of New Hampshire. Now everywhere I look it's either a Granite Bank or a Bank of New Hampshire.

Y2K News

Maybe you read about the emergency control center in Cheyenne Mountain testing their computer system to make sure it was Y2K compliant. They reset their computers to December 31, 1999, and waited for the clock to roll over to January 1, 2000. Instead, everything just shut down.

The Russians have just recently been made aware of the Y2K problem. After a survey they've decided there's nothing they really can do about it. They don't have the programmers or the money to tackle the problem, so they've opted to just wait and see what happens.

One (me, for instance) wonders what's going to happen when the control systems preventing nuclear missile firing shut down all over their country.

Is it really possible that our major corporations, and our government, have been ignoring the problems that their computers are going to experience come January 1, 2000? Is it possible, as Gary North is predicting, that our telephone system, power companies, and most government operations will suddenly stop that Saturday morning? This is so completely beyond belief that the natural reaction is to pooh-pooh the whole idea.

To get a better understanding of what's involved, visit [www.garynorth.com] and start reading the postings. There are some from skeptics, but you'll note that these birds don't have much in the way of credentials. When you start reading the postings from the systems analysts and programmers who're in the trenches, it's "Oh, my God!" If I were trying to get the real impact across I'd make that about *six* exclamation points, not one. But I'm conservative, so you do some homework and start blowing your mind at what you learn.

The people at my bank say it's Y2K compliant. But they admit that they are tied in with their whole banking system, which isn't, and that the whole system could crash as a result.

Without money, power, gasoline, and food deliveries, telephones, and so on, your company will have to close down until the whole infrastructure is up and running again. And that could take weeks, months, or even years.

Maybe you're still in Y2K denial, a comfortable area which is densely populated with our managerial elite. Then, how about a little more homework. Try investing $20 in Yourdon's *Time Bomb 2000* (Prentice-Hall). Ed explains why our hospitals, police, water, electricity, mail, schools, and so on are likely to stop, possibly for weeks to months.

So what's the problem? It's that many computer systems have been programmed to read year 00 as 1900 instead of 2000. We're talking about thousands of mainframe systems, where most of the original programmers are retired or dead, the languages and compilers they used are

Continued on page 60

***Photo A.** The DSP-599zx has a relatively small footprint, about 7-1/2 inches wide. I thought at first the size of the buttons would make operation difficult, but there is plenty of room for me to get to side-by-side buttons to press them simultaneously. The display window keeps you abreast of the many functions and is quite readable from across the operating table.*

DSP technology on display at ham stores and wasn't overly impressed.

Enter the DSP-599zx

No ringing. Just tune, adjust/tweak, and copy. This means that here is a piece of equipment that can make the digital modes really come to life when a lot of the signals I hear are barely moving the S-meter.

When tuning RTTY through the PK232, the tuning indicator on the 599zx is the first area on which to focus. When the indicator shows about equal deflection in both directions, the copy may appear on the monitor, but sometimes there are garbage strings. Then, by following the instructions to tweak the knobs on the front panel, the copy, as if by magic, becomes solid.

The 599zx has another feature that makes a huge difference. After demodulating the signal, you can put it in the remodulate mode and the signal is fed to the PK232 as pure as if the transmitter were across town.

Several novel effects are noticeable. The first one is manifested at the tuning bars on the PK232: They suddenly display only mark and space bars, and there are no hash bars in between! The second is that if the signal isn't absolutely clean, I could tweak the receiver tuning just slightly and everything would clear up and the copy would be as close to 100% as conditions would allow. As mentioned above, this tweaking could be accomplished on the front panel of the 599zx. And remember, this was with most signals at about S-0.

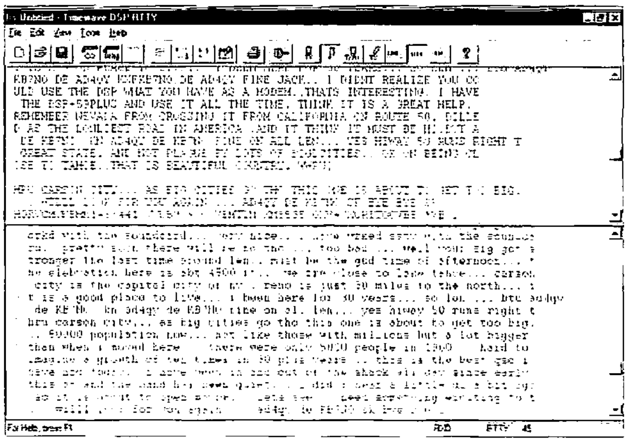


***Fig. 1.** This was a portion of a QSO using DSP-RTTY, in which we were discussing the use of various methods of handling RTTY. The split screen is obvious. Timewave gives an example with a third screen to allow simultaneous monitoring of the DX-Cluster, but my computer does not have enough serial ports at this time.*

A third effect tells the real story. Ham bands just don't sound right to me unless I can hear most of the spectrum up and down from the signal I am tuning to. Therefore, for a time I left the speaker connected to the audio before the DSP filter when listening to digital modes. The 599zx has a speaker output that I plugged the headphones into (this is the recommended connection for the station speaker, and by the end of a few days I grew into that mode). The difference is dramatic; the signal is there, the noise is gone.

Of course, when working sideband it is necessary to use the filtered output or there is no effect. For creatures such as I, Timewave built in a quick bypass feature: Toggle the bypass button and the filter is in or out of there in an instant. You can have it both ways.

A very convincing advantage came to light as I was working Ulf DL5AXX with RTTY. His signal was quite readable, but he complained that mine was a bit rough to copy and he pulled it out by using his DSP. The story unfolded within a minute as I was sending the last round of the QSO. My amplifier bit the dust, which meant that my signal hadn't been nearly where it should have been, but DSP had rescued the contact. I signed with Ulf *sans* the amplifier and was under the distinct impression he was still copying me due to the technology at his end. If the contact had lasted one more time around, I would have asked what DSP unit he used.

Great software

Now, you can take full advantage of the unit without the need for a TNC between it and your computer. The new DSP-RTTY program does that and the features are designed for the serious RTTY operator.

This program installs easily into Windows 95™, Windows 98™, or Windows NT™. Installation is intuitive and takes care of itself, as we have learned to expect from good Windows programs. Follow the simple instructions and you will be up and running in minutes. The documentation is straightforward.

The biggest help is within the online help files. You will find how to edit the macros and create your own for nearly effortless communication. Instructions are included for such things as inserting the station's call you are about to work, which is started by pressing [Alt-K] for the pop-up window. Then, when you wish to insert the call into text, you merely use [Ctrl-K] and it appears. You do the same to insert your own call into the text with [Ctrl-C].

It becomes quite natural after a few times around and leaves time to think ahead instead of search the screen for the other station's call. I find I can cut down on the repetitive chores and focus instead on the operator's name and interests. Keeps my head from hurting needlessly.

The fact is, when you take full advantage of the program, you can rattle along with intelligible exchanges more quickly than if you had a self-correcting link with PACTOR or AMTOR. This is not to say you will not miss a few characters now and then, but there is no delay in waiting for the transmissions to become perfect.

Simple hookup

Connect the serial cable from the computer to the 599zx (supplied), a cable from the speaker output to the back of the 599zx (roll your own), add the radio to 599zx cable that comes with the DIN connector at one end to fit the 599zx, and you are nearly there. Connect 12 VDC and

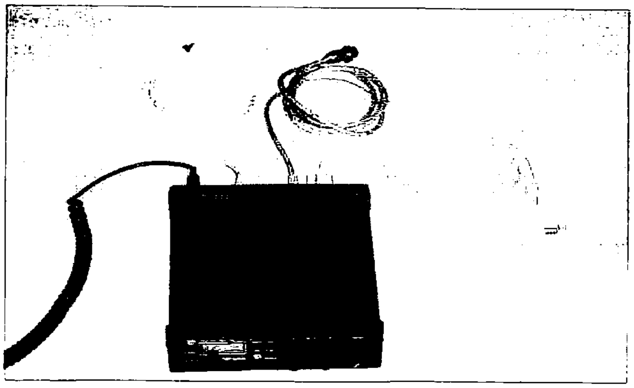


Photo ***B****. Hookup is made simple. The DSP-RTTY software comes packaged with a 9-pin to 9-pin serial cable and an interface cable with the DIN connector wired on the DSP-599zx end and instructions to wire the other end to connect to your radio. You need a 12 volt (cable not shown) and speaker output cable. The cable to the left is from the speaker output of the 599 to a set of headphones.*

plug-in speakers or headphones to complete the job. (See **Photo B.**) The radio connection is the only challenge, but the 599zx can be made to work with any modern transceiver. Timewave has a tech line and they have heard just about all the common connection questions.

The program is intuitive and intended for the serious RTTY *aficionado*. One of the features that struck me right away is a button to click to send what I had typed ahead, and then return automatically when the message was sent to receive. And the send-receive transition is immediate. Some Windows programs seem to spend several seconds during the changeover.

There are almost countless possibilities for macros to send everything from your call to automatic CQ, to a brag tape, to contest exchanges that you can modify to suit your needs and taste.

The remodulate mode that works with a TNC does not work with the modem, but it is not necessary; the demodulated signal is about as pure as it can get when it gets to the program in the computer.

I had at this point broken myself of the habit of listening to the "raw" signals coming in from the radio. There is a bypass that allows for that exercise, and you will be amazed at the noise on the band sometimes when you bypass the 599zx. Also, I found that if I allowed the regular speaker output to run the station speaker, the audio available for the 599zx was noticeably reduced.

Press the bypass button during marginal conditions and copy will usually turn to unreadable garble or completely disappear from the monitor. Plus, you will notice that if there is a lot of interference on frequency, the signal will disappear into the depths of the "hash" when you press the bypass button; then, miraculously, when you toggle the button out of the bypass mode, the signal emerges audibly and the received copy displays on the screen. This happens almost instantly.

One evening, the local atmospheric noise was exceptionally bad and I found the true value of tuning with the filter on and doing its job. The noise was registering an S-5 on the meter and there were no audible signals. But there were signals. All that was necessary was to tune slowly through the RTTY window and signals would show themselves. With a little careful tweaking, I copied nearly every one of them. And they were weak signals, believe me. Without the noise, I doubt if there would have been any movement of the S-meter.

All in all, I am totally enamored with the DSP-599zx and the DSP-RTTY software. The DSP-599zx by itself helps all modes, but their modem program is the showstopper. As I spoke to John Douglas at Timewave, I mentioned the fact that they would have a hard time prying them out of my fingers. The

Current Web Addresses

Source for:	Web address (URL)
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free programs	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom - German site	http://www.baycom.de/
Pasokon SSTV programs & hardware	http://www.ultranet.com/~sstv/lite.html
Winpack shareware for Windows	http://www.duckles.demon.co.uk/ham/wp.htm
Baycom 1.5 and Manual.zip in English	http://www.cs.wvu.edu/~acm/gopher/Software/baycom/
Tucson Amateur Packet Radio—where packet started—new modes on the way	http://www.tapr.org
TNC to radio wiring help	http://prairie.lakes.com/~medcalf/ztx/wire/
ChromaPIX & W95SSTV	http://www.siliconpixels.com/
Timewave DSP & former AEA prod	http://www.timewave.com
VHF packet serial modem kit	http://www.ldgelectronics.com

Table 1*. Current Web addresses. All of the above were cut and pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later.*

Number 42 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. The series began in the January 1998 "Ham To Ham" column and Part 9 follows:

Lightning protection—what your mother never told you!

Longevity

After a ground system has been installed, inevitably it begins to age. Copper and other metals are attacked by acids while aluminum is attacked by bases. In addition, other chemicals may be present in the soil which can cause decreased effectiveness of the grounding materials.

Maintenance testing is important. While some ground systems will last 30 years, others are not nearly as durable. The proper way to test the effectiveness of a grounding system is to use an earth resistance meter, which will provide a "fall of potential" type of test.

Safety hint: Use caution when connecting a ground system to the existing electrical utility ground rod. Depending on ground conductivity, harmonic and other currents could flow, causing a spark when connected.

Having VSWR trouble or telephone interference with your multiband HF vertical? When you have a ground-mounted multiband HF vertical antenna, the ground radials normally connect to the coax cable's shield. Since the equipment end of the coax line will be at some random length (which can approach a quarter wave or some multiple thereof) from the antenna, RF energy, using the coax's shield as a radial, will show up as high VSWR on that band or bands. It can be corrected by decoupling the coax with a "poor man's balun." Even though a ground-mounted quarter-wave vertical is not a balanced antenna (and shouldn't need a balun), the technique works because the coil also acts as an RF choke to RF currents traveling on the cable's outside shield. RF currents on the inner surface of the shield are a necessary part of the circuit path, but not on the outside surface. You can easily form an RF choke by making an eight-turn coil, six inches in diameter, right in your coax feedline. Give it a try if you're experiencing the problem mentioned. If your coax goes up from ground level to a first or second story level, the radiated near-field energy from the antenna will also give "higher VSWR-like" indications. This can be fixed by adding another coax coil (in the same manner as above), but this time near the transmitter. This "choke" will provide a high impedance to the captured RF on the coax's outside shield surface and reflect it back. If a decoupling coil is present near the antenna feed (described above), the RF will continue to bounce back and forth until it's either radiated or lost due to resistance, with no effect on your measured VSWR. Additionally, if you don't eliminate the RF riding on the outside of the coax cable, it can make the equipment cabinet high (hot) with RF voltage. Since the cabinet is connected to the power safety ground, if you're not using the recommended single point grounding technique, the safety ground will carry the RF to the telephone company-installed protector. Chances are, the utility safety power ground is poor or is highly inductive. The RF will then likely fire the telephone company's protector, causing interference to your phone. It can even cross-couple to other lines in the same cable run to the central office.

Providing a good earth ground for both lightning and RF, interconnecting the utility safety ground into your overall ground system, using a single-point ground configuration (as we've discussed in previous installments) and installing a low-inductance interconnect path between the single-point and the external ground system will do a lot toward eliminating these RFI problems (in addition to protecting you from lightning surge currents).

Moderator's note: In another section of this series we were warned about coils in the coax cable feedlines acting as air-wound pickup coils for the magnetic field generated by a lightning stroke. That danger still exists (as previously detailed), so the suggestions given here are not completely without their inherent drawbacks. One solution may be to enclose the coils of coax just mentioned inside a magnetically shielded metal container that's properly bonded to the single-point ground at the outdoor end and to the single-point ground at the station end.

Do you know why steel ground rods are copperplated? If you answered "to increase conductivity," you'd better read on. The base metal, steel, is more conductive than the best soil or even salt water. The real reason is for corrosion resistance. Copper, silver, mercury and gold all have high resistance to corrosion. Those metals that are never found free in nature, like aluminum and magnesium, are easily corroded. Noble metals (like copper) become the cathode when joined together with less noble metals in the presence of an electrolyte (ionic water). Less noble metals become the sacrificial anode and corrode away.

Graphite (though not technically a metal) is even more noble than silver and certainly much nobler than copper. Therefore, if a graphite backfill material is used as a ground enhancer to surround copper, the copper will be sacrificial to the graphite and will dissolve away into the ground.

The following affect the amount and speed of corrosion both above and below the soil:

Water. The presence of water, mixed with contaminants, is the basis of galvanic corrosion. Pure rain water is slightly acidic (pH 5.5 to 6.0). It picks up carbon dioxide as it falls, which creates carbonic acid. It can start attacking some metals, even copper, without being in a junction. The ions etched from the copper go into solution in the rain water. As this rain

---

hardware sells for $369.95 and there is a version that fits into the Yaesu SP-5/SP-6 speaker with nearly identical features available for $349.95. The program sells for $69.95 and I understand there are plans to further enhance it with logging features. At this time, the screen activity can be directed to files on disk for later reference. Timewave does have a Web site. (See **Table 1**.)

If you have questions or comments about this column, please E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. On packet, I see my current PBBS address is shutting down. If your packet mail comes back or is not answered, that is the reason. I am searching for a new address. For now, 73, Jack KB7NO.

water drips on galvanized tower sections, it will cause the zinc to combine and wash off. This leaves the bare steel to oxidize away.

Oxygen. This is the main corrosion accelerator. Rain water also picks up oxygen as it falls through the atmosphere; water is an excellent carrier of oxygen.

Temperature. Generally, the higher the temperature, the faster the chemical reaction.

Texture of the metal(s). Glass-smooth surfaces are less likely to corrode than rough finishes.

Hydrogen Sulfide. A gaseous product of exhaust emissions, it combines with rain water, creating acid rain.

Chlorine. Tap water can have an acidic effect on underground materials.

Inert gases. Helium displaces oxygen and reduces the corrosive effect.

Alkaline. Although some alkalis tend to increase the rate of carbon dioxide absorption from the air (which creates corrosive carbonate solutions), slight amounts of alkalinity can reduce corrosion rates.

Salts. Sodium chloride (found just about everywhere) increases the soil conductivity and also increases the corrosion process (in nearly the same proportion to its concentration). Other naturally-occurring salts or man-added salts will do about the same. Only sodium carbonate or phosphate and potassium ferrocyanide form a protective film that prevents further corrosion.

Microorganisms. Both bacteria and fungi can cause metal to deteriorate. Some will give off acids in trapped water, or, when they die, will decompose into acids.

There are several types of corrosion. Listed below are the common names given for descriptive purposes:

Uniform Etch. A direct chemical attack from salts, urine and acids. If allowed to continue, a polished surface will dull and then take on a rough or frosted appearance.

Pitting. Tiny pinholes from localized chemical or galvanic attack.

Intergranular. Usually galvanic, this is a selective attack along the grain boundaries of an alloy metal. We refer to this as "de-alloying." Typical corrosion-resistant alloys can break down when corrosion actually works on the individual components of the alloy.

Exfoliation. Found on extruded metals, the corrosion occurs just below the metal surface and causes a blister to form. This appears where the extruding dyes have forced the crystal structure of the metal to change direction.

Galvanic. This is the classic two-dissimilar-metal-connection, with a water electrolyte bridge, and is the most basic of corrosion problems.

Concentration Cell. As the amount of oxygen reaching the electrolyte varies, the rate of corrosion will vary accordingly. Highly concentrated areas of oxygen will have high levels of corrosion.

Stress. More corrosion will occur where high tensile stress is applied. This occurs where metal is bent or where rivets have been driven in, and in metals that have been cold-worked (bent back and forth several times). Copper is easily cold-worked and should be annealed (stress relieved by heating). Stress corrosion appears as a crack running parallel to the metal's grain.

Fatigue. Another form of stress corrosion where pits are defined along the grain. Additional stress begins to concentrate around them and cracking occurs at the bottom of the pits.

Filiform. Thread-like filament corrosion occurring under painted surfaces where water and oxygen have penetrated and form a corrosion concentration cell.

That's Roger and Ron's presentation for this month. The "Ham To Ham" column will continue this series on protecting your ham station from the destructive effects of a lightning strike with Part 10, the final installment, coming up next month.

Making the cut!

From Stephen Reynolds NØPOU: "Used, nonworking camcorders are popping up more and more at garage sales, flea markets and even hamfests these days. Many people simply replace an inoperative camcorder with a newer one, rather than pay the high price of having an older model fixed. Since most camcorders come with a carrying case, battery and battery charger, even if you'd rather not get involved in trying to fix the camcorder, these accessories can often be very useful in and of themselves.

"The carrying cases are usually pretty sturdy, so a few minutes modifying the case for other purposes can be well worth the effort. If needed, the inside of the typical camcorder case can usually be cut away, leaving the outer shell for storage of ham gear for QRP operation, Field Day, vacation or other needs. The best method

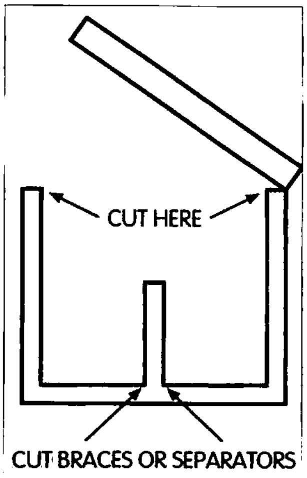


Fig. 1. Dissecting a camcorder case.

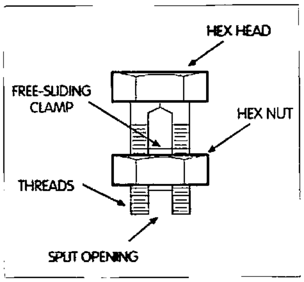


Fig. 2. Anatomy of a split bolt.

that I've found is to use a sharp utiiity knife to cut just under the inside lip (as shown in **Fig. 1**). On some cases, you'll also have to cut out some braces or separators, but they do normally all come out. The gutted case can then be lined with foam rubber, and custom separators can be added as needed to accommodate your own particular ham equipment.

"Need an auxiliary battery for your hamfest HT or perhaps as a backup to a QRP rig? Some of the older camcorders have fairly husky rechargeable battery packs as a part of their package. It's often possible to remove the camcorder's battery holder (the holder that the battery clips onto) from the body of the camcorder without a great deal of work. Some simply snap onto the body, others are held in place with several small screws, but a few may require some surgery in the form of a sharp utility knife and/or a fine-toothed hacksaw to part them from their hosts! Be very careful if you encountered the latter; it may not be worth the risk of personal injury and/or damage to the holder itself. Providing that the battery and its charger are in good working order (you tried that first, of course), you should now have a combination that will serve you for some time."

A "close-in" antenna for 40

From Bruce Cameron WA4UZM: "While the most basic amateur antenna remains the simple dipole, if you construct it strictly from 300-ohm ribbon lead (as often recommended in the books), it probably won't even come close to matching your modern, 50-ohm-only solid state transceiver's input/output impedance. For years, I've successfully center-fed a 40-meter dipole, consisting of about 64 feet of wire, with either RG-8 or RG-58 50-ohm cable, and with the flat-top of the antenna only eight to 10 feet above the ground. The low overall height gives a very high radiation angle, which is ideal for close-in work or statewide nets. The mismatch is tolerable (being about 40 ohms instead of 50) and the tuning is fairly straightforward.

"Careful tuning is a must for best results, but it doesn't take all that much effort or equipment. The easiest way is with one of the newer, self-excited RF bridges, coupled with lots of patience. I've found the best way is to start with 66 feet of wire, looped through egg insulators at each end, doubled back on itself, and temporarily secured with split bolts. Try to keep both halves of the dipole as close to the same length (symmetrical) as you can, for best results. You should be able to end up with an SWR of 1.5 to 1 or less (though you'll probably notice an SWR change between wet and dry ground). My present antenna is simply made of split zip-cord; I've heard some people say that insulated wire is less prone to noise."

Moderator's note: If you're not familiar with the split bolts that Bruce refers to in his tip, stop by your local hardware store or electrical supply shop and show them the drawing in ***Fig. 2****. A split bolt, as the name implies, is basically a brass bolt, with a slit down the center and a free-sliding clamp and nut on one end. The main antenna wire, and its looped-back end, occupy the space inside the slit, and the free-sliding clamp piece and nut are snugged up to hold the combination firmly in place. If you need a little more or a little less wire during your antenna tune-up trials, just loosen the nut on the split bolt and adjust the length of wire as needed. A split bolt on each wire end can also serve as the permanent method of securing the assembly once it has been successfully tuned. Additionally, I think that Bruce's reference to insulated wire being less prone to noise may stem from the fact that when bare stranded copper wire is exposed to the elements, the individual copper strands tend to partially self-insulate from each other as copper corrosion develops over time. As the antenna wire moves, due to the wind, or expansion and contraction with temperature changes, small amounts of noise voltage may be generated by the partially-insulated individual strands rubbing together. Weathertight, insulated, stranded conductors and bare solid wire don't exhibit this tendency. Also keep in mind that any insulated antenna wire will add apparent length to the dipole's size, so the exact end-result length may be somewhat different from what the formulas and antenna book tables show as the normal "finished length" of a dipole for a particular frequency. The finished antenna's height above ground (and surrounding objects in the near field) will also affect the antenna's naturally resonant frequency. Finally, plain copper wire (even if covered with plastic insulation) will tend to stretch more than copper-coated steel antenna wire, so some adjustment with time and weather conditions may be necessary (significant sag might occur with a heavy winter icing, for instance).*

Murphy's Corollary: Everything, except getting into hot water, always takes longer than expected.

That's all for this month. Thanks for tuning in the "Ham To Ham" column, and please keep this column in mind when you have something that you'd like to contribute. Some of the best information that we can apply to our day-to-day ham radio operation comes from others who've encountered similar situations ... and found workable solutions. As "Ham To Ham" concludes its third year on the pages of *73* with this issue, many thanks, as always, to our loyal contributors, including:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000
[http://www.polyphaser.com/]

Stephen Reynolds NØPOU
510 South 130th Street
Omaha NE
68154

W. Bruce Cameron WA4UZM
430 Doric Court
Tarpon Springs FL
34689-2524

If you're missing any past columns, you can probably find them at *73's* "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73*.

Number 45 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

The Dayton Youth Forum on Saturday, May 16, 1998 at Hamvention™ was a fun place to be this year. I am always impressed with the number of bright, articulate youngsters across the country who are involved in exciting aspects of ham radio. It's a pleasure to interview these young people during the year and present them at a national forum where they are able to showcase their skills and share their enthusiasm with others.

My first speaker was John Pituch W2MBY, who is 11 years old, from Livingston, New Jersey. John has been licensed since August, 1997. His dad, W2MY, first got him interested in the hobby by inviting him to come along to various Field Day and other public service events.

John feels it is very important to have a young ham be part of any presentation about ham radio that an adult is giving. That way the prospective young hams in the audience can say, "Hey, I can do that."

He's a member of the ARRL, QRP Amateur Radio Club International, FISTS, New Jersey QRP Club, Internet QRP Club, and 10-10 International. His favorite ham activities are HF CW, contesting, DX, ragchewing, and public service.

John had a wonderful slide presentation which showed lots of fun activities for young people.

The second speaker was Crystal Hart KCØAJF, 12 years old, from Boulder, Colorado (**Photo A**). Crystal has been a member of BARC Jr. for one year. This group is the youth auxiliary club of the Boulder Amateur Radio Club. Ellie and Rip Van Winkle, who are the "heart and soul" of this young adult club, have organized efforts for the past several years to send wonderful, articulate children as representatives to appear at my youth forum in Dayton. Elmers such as the Van Winkles are a gift to amateur radio.

Crystal shared with the audience that she has her General license along with 20-word code credit towards her Extra ticket. She had a wonderful slide presentation which highlighted many of her favorite activities in ham radio. Crystal explained "home-brew" to the newcomers in the audience. She enjoys building her own equipment. We saw slides of a J-pole antenna and some other equipment she built, soldered, and debugged by herself.

Photo A. Crystal Hart KCØAJF, 12, Rebecca Rich KBØVVT, 8 years old, and Carole Perry at the 1998 Dayton Youth Forum. Photo by Dave Rich KGØUS.

Photo B. Blair Harness KBØROM, 17, Tech-plus. Photo by Carole Perry.

Crystal has started a ham radio club in her middle school and has encouraged her teacher to sponsor it.

Every once in awhile I invite an adult to speak at this forum. John Crovelli W2GD, from Bridgewater, New Jersey, gave a talk on contesting and how it can be a great experience for kids. He got interested in ham radio at age 10 and since has become well known as a DXer and a contester. He feels that children can learn so much from this part of the hobby that they should be encouraged to participate in it.

John pointed out that through contesting children can learn about propagation, radio wave phenomena, and basic electronics. He also had a slide presentation of impressive highlights of the fun and achievements he has had over the years.

Richard Stubbs KC5NSZ is the customer service manager for MFJ. He and Martin Ju, the founder of MFJ, have made appearances to donate equipment at my youth forums for the past six years. They are extremely supportive of educational efforts to encourage children to get into the hobby. It's always a pleasure to have their participation, and of course the youngsters in the audience look forward to the drawing for prizes. This year MFJ donated a six-meter rig as a prize. The happy recipients keep coming back to the youth forum every year to reminisce with the audience. It's a lot of fun.

The next young lady is a real showstopper. Eight-year-old

Photo C. Jonathan Chambers KBØTKD, 16. Photo by Carole Perry.

Number 46 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

Last month we asked a hard question: Does Phase 3D have a ride? Since then it has been learned that the answer is NO. AMSAT's newest satellite will not be launched on the third test flight (AR503) of the *Ariane 5* rocket. On June 15th. Phase 3D Project Leader and AMSAT-DL President Karl Meinzer DJ4ZC was informed by the European Space Agency (ESA) program board that Phase 3D would not be included on the manifest for the *Ariane 503*.

In an unexpected turn of events, Arianespace, the privately held commercial company that provides launchers for ESA, announced that they would cover the remaining development cost of *Ariane 503* in return for complete control of the lower payload space on the flight, the spot Phase 3D would have had. The $35 to $40 million that Arianespace brings to the ESA program board is far more than AMSAT groups around the world can match. Cash talks.

The purchase of the launch space on AR503 is considered by some to be a conflict of interests for Arianespace. In addition to being the launch provider, they are now also a customer. Originally it was thought that they would send a dummy satellite, just a dead-weight mass, on the flight to expedite the launch timetable. It is possible that they may adjust the launch data sufficiently to allow time for repairs to a communications satellite that was damaged in the lab. With a successful launch of a functioning satellite in the place of a dummy, they could then market the communications channel of the satellite, and become not only a launch customer, but also a communications provider and broker.

Adversity and opportunity

When Phase 3D was not ready for the *Ariane 502* launch

Photo A. Andy W5ACM experiments with a Grundig Yacht Boy 400 receiver and a two-meter HT using a 5/8-wave whip antenna for RS-12 Mode "A" satellite operation.

last year, the ESA declared their contract with AMSAT to be void. They ignored the fact that the flight requirements had changed. The changes caused serious time and money problems for AMSAT, which was hard at work mechanically strengthening Phase 3D for the anticipated rough ride of an *Ariane 5* booster. In January

---

Rebecca Rich KBØVVT is an Extra class license holder from Missouri who comes from a ham family. When her dad, David KGØUS, designed a computer program for her mom Barbara KGØUT, Rebecca started to play with it. She found she could answer many of the questions. At the age of six, Rebecca earned her Technician license and told her parents she enjoyed it so much she wanted to go higher. After she got her Advanced license, the pressure was on for the whole family to study for their Extras.

They all took the test in March, 1997, and all of them passed. Rebecca is currently the youngest Extra class in the United States. Mom gave a follow-up presentation to Rebecca's talk at the forum. She outlined the study guides they followed, allotting times for code practice and sections of the theory. Both parents stressed that when working with children, it's important to limit the study time, make sure they can read and understand the test words, and most importantly, that they have fun!

The next speaker was another youngster from BARC Jr., Blair Harness KBØROM. Blair (**Photo B**) is 17 years old and has a Tech-plus license. He has been with the group for four years, during which time he has held office as vice president, secretary, and treasurer. Blair has been the Field Day chairman for BARC Jr. for the past three years. He had a wonderful slide presentation of BARC Jr. at various Field Day activities. He stressed how important the role of Elmers is for a club of young people. They truly appreciate the tremendous efforts of these instructors and Elmers at events like Field Day, where there is so much to do.

After Blair spoke, I had the Elmers who had accompanied the BARC Jr. speakers to Dayton stand up for deserved recognition. Never underestimate the importance of strong adult support when working with children.

This was the year of great contributions to the youth forum from the state of Colorado. Bill Nesbitt KGØZI brought the most wonderful group of presenters from Grand Junction, Colorado. They belong to ARFY—Amateur Radio For Youth. This began as a group of adults who encouraged youngsters to get involved in the hobby, but quickly turned into a 16-member club for young adults who look to the "geezers," as they call them, for advice.

The very articulate Andrew Be KJØJZ is 14 years old, and is the president of ARFY. Andrew talked about the club's activities, including having a Web site [http://www.mesa.k12.co.us./mgm/arfy/].

Jonathan Chambers KBØTKD, age 16 (**Photo C**), described and showed slides of ARFY's DXpeditions to two US islands, 001R Skipper's Island and Watson Island 002R, both in the Colorado River. Both events exposed the kids to HF operating and gave them the excitement and experience of working huge pileups.

Denis Campbell AAØYX also came along from ARFY to describe some of the terrific experiences the young people are having in this group. To educate more kids about ham radio, the ARFY kids put on a series of classes at "Super Saturday," held at a local middle school. The kids put up a portable 50-foot tower in front of the school and let other kids get on and talk to people all over the country.

At the end of the forum I had my friend Bob Grove from *Monitoring Times* magazine draw for the winner of an ICOM dual-band radio. ICOM is usually represented at my forums by Chris Lougee, who has been supportive of my efforts with children in ham radio for many years. My thanks to all the manufacturers who help add that extra touch of excitement to the youth forum each year by putting radios into the hands of young adults.

Be sure to be on the lookout for young people who would enjoy being presenters at Dayton next year. Have them get in touch with me at the address at the top of my column or at [wb2mgp@ix.netcom.com]. 73

Photo B. Andy W5ACM and Mike WA5TWT try out the Yaesu FT-847 for portable satellite contacts while out on a fishing trip in central Texas.

AMSAT accepted cancellation of their launch contract with the ESA, provided that ESA would carry Phase 3D as a backup on AR503 if no paying customer could be identified. In the event that a paying customer could be found for AR503, the ESA agreed to use best efforts to provide a ride for Phase 3D on another flight. When Arianespace bought the spot on AR503, AMSAT was left out, and now is looking to the ESA to provide a future launch opportunity.

The AMSAT organizations involved with the design and construction of Phase 3D are in agreement for some near-term plans for the now-grounded satellite. The first order of business is to complete any last-minute issues in the satellite systems. They will also provide travel, lab and storage insurance for the satellite. Phase 3D will then go through vibration and vacuum testing, followed by possible shipment to Germany. The AMSAT Phase 3D lab in Orlando, Florida, cannot be kept open indefinitely—the building itself is scheduled for replacement next year. While in Germany, the satellite can be checked and maintained in anticipation of a launch either next year or the year after. In the meantime, other launchers from other countries will be investigated as possible rides to orbit should the ESA fail to offer an alternative.

Photo C. A close-up of the Yaesu FT-847 portable station with the FP-1030A power supply and a Whiterook Products Company keyer paddle (Model MK-44).

Fun stuff

It's not always convenient to take a full-sized hamsat Earth station along on camping trips, vacations, or just on the road for some mobile fun. The radios, associated power source, and normal satellite antennas are just too large and heavy. A high-end home station may have two or three radios for HF, VHF and UHF. Power amplifiers, preamplifiers and a large DC supply may also be present. For antennas, the station might include dipoles, verticals or beams for HF, and an array of high-gain, circularly-polarized yagis on azimuth/elevation rotators for VHF and UHF. Getting this much equipment in a car is hard. Getting it all operational for mobile work yields cover pictures for ham radio magazines.

There are alternatives. For camping, where power is at a premium, HTs and other similarly-sized radios can provide a means to get signals up to and down from low-Earth-orbit satellites. On a recent Boy Scout camping trip I tried RS-12 Mode A operation (two meters up and 10 meters down) with a minimal portable station. On the uplink a two-meter HT was employed with a 5/8-wave whip. The one-watt FM radio was keyed on and off with a standard key. I had successfully tested this HT for CW chirp. It had a relatively clean signal (many HTs do not). On the downlink, I use a Grundig Yacht Boy 400 general-coverage receiver. I could hear my signal through the transponder, but the system was not sufficient for good contacts. While the uplink was adequate when the transponder was lightly loaded, the downlink reception was poor. The short built-in whip antenna on the Grundig was not up to the job. A good dipole strung in the trees would have made quite a difference.

During a fishing trip to central Texas I again used omni antennas, but took along the new Yaesu FT-847 satellite radio. This rig has 100 watts out on HF and six meters, and 50 watts out on two meters and 70 cm. It also has built-in preamplifiers. This time a good dipole was strung up for 10 meters. An old Ringo Ranger was used for two meters and an M-Squared 70 cm "Eggbeater" antenna (Model EB-432) was mounted on a stepladder with the optional reflector kit (Model RK-70).

Photo D. The M-Squared 70 cm "Eggbeater" antenna provided reasonable satellite reception and was easily mounted to a spare stepladder.

The rig, microphone and Whiterook Products Company keyer paddle (Model MK-44) all fit in a large briefcase with room for satellite prediction listings and other items. The rig performed flawlessly. The extra power on the uplink and the built-in, low-noise preamplifiers overcame the deficiencies of the omni antennas, and many

Continued on page 50

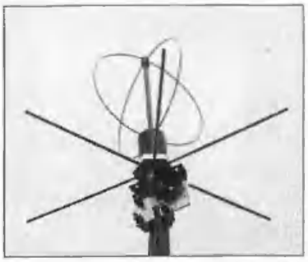
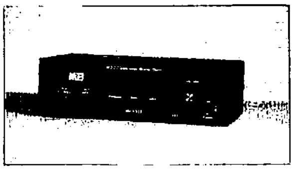


Photo E. A close-up of the M-Squared 70 cm "Eggbeater" antenna (Model EB-432) with the optional reflector kit (Model RK-70).

New Products



Elmers, Take Note!

The new MFJ-414 tutor is "the Cadillac of Morse code trainers," designed for professional classroom use. It's ideal for VE examiners, ham radio classes, clubs, Elmers ... well, everyone who wants the best Morse code tutor available.

Features include an LCD readout and printer port, which is useful for printing out correct answers so that students can check copy after a code practice session. If a student is having trouble with certain characters, you can build and save three custom sets (16 characters each) for extra practice.

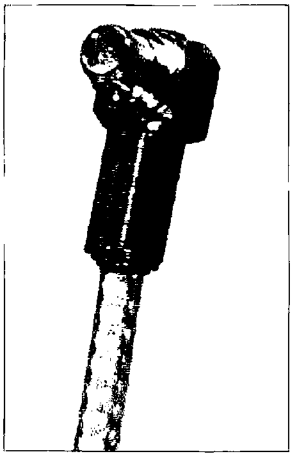
The MFJ-414 will also store up to 16 FCC exams; you can generate actual FCC exams and download them to the MFJ-414 to test future hams and upgrades.

It's a full-featured memory keyer, too, with 1000-character memory, semi/auto modes, iambic A/B, reverse paddle, change speed and tone-on-the-fly.

You can use the powerful built-in speaker or external speaker or headphones. The MFJ-414 includes a serial port cable and open-end patch cable, and, as always, MFJ's famous *No Matter What*™ one-year limited warranty.

To order or for information about your nearest dealer, call (800) 647-1800; FAX (601) 323-6551; E-mail [mfj@mfj-enterprises.com]; or check out dealer and ordering information on the Web site at [http://www.mfjenterprises.com].

"You Can't Escape the Curse of the Mummy's Hound, Professor!"



OK, so it's not really Egyptian funerary art, but it *is* gold-plated, and it looks like it might have been found in some ancient tomb ... oh, all right—you guys are so stuffy sometimes!

What it really is, is the RFX-9010-1A, an example of one of the new MMCX connectors from RF Connectors, designed for use in applications where space constraints mean minimal sizes of RG178/U cable connectors. Straight and right-angle styles are available in PCB, crimp plug and jack configurations, and made of brass with nickel or gold-plated bodies, gold-plated contacts and Teflon™ insulation. See your RF Connectors distributor, or for additional information call (800) 233-1728.

Your new product release could be here.
Send it!
(With a photo, of course!)

It's Here!

Ever since Hamtronics announced its new line of VHF FM exciter and receivers using new low-noise frequency synthesis technology, customers have demanded to know when they'd be available for the UHF bands. The wait is over.

The new T304 exciter and R304 receiver provide high-quality NBFM and FSK operation for UHF ham bands in the 420–450 MHz range and for adjacent bands from 400–470 MHz. Features include dip switch frequency selection, low phase noise synthesizer for applications, and more.

The T304 exciter uses direct FM modulation, which allows FSK transmission of data up to 9600 baud. Power output is 2–3 W and is rated for continuous duty in demanding applications, such as repeater service. The R304 receiver has the same fine sensitivity, selectivity, and squelch as other Hamtronics receivers, and modules are designed to be easy to align and repair.

Need more? They're both available either in kit form or factory-wired and tested—the T301 for $149/$189, the R301 $179/$209 respectively.

For more information, check the Hamtronics Web site at [http://www.hamtronics.com], which includes all the Hamtronics gear; or for a printed catalog, write to Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535. You can also call (716) 392-9430; FAX (716) 392-9420; or E-mail [jv@hamtronics.com]. And let 'em know you saw it in *73*!

New Title!

The ARRL experts have put together the definitive compilation of advice and information on every type of interference, from automotive to lamps to VCRs to stereos to your station receiver—well, if it can be affected by interference, you'll find practical solutions in *The ARRL RFI Book*.

The previous ARRL interference book, *Radio Frequency Interference, How to Find It and Fix It*, has been thoroughly rewritten for the most up-to-date answers about problems, cures, and RFI regulations, and the suppliers list and bibliography have been extensively updated.

Order ARRL #6834 from ARRL, 225 Main Street, Newington CT 06111, or see your dealer.

PacTerm 98

Kantronics and Creative Services Software have teamed up to produce a new 32-bit Windows terminal program for the Kantronics TNC. PacTerm 98 requires Windows 95®, Windows 98®, or Windows NT® with eight meg of RAM and six megabytes of free hard drive space. The program supports Com1 through Com35 and has point-and-click commands for the VHF and HF modes that the Kantronics TNCs support.

From CW to HF packet, it's now even more fun to use the digital modes of amateur radio. Capabilities include: G-TOR monitoring; stream selection with a click of the mouse; text and binary file transfers; user-defined colors and fonts for received, transmitted, and command text; mini-logging program; support for CD-ROM-based Callbooks—and lots more!

The suggested retail price of the PacTerm 98 is $69.95. You can check the Web sites at [http://www.kantronics.com] and [http://www.cssincorp.com] for further details and purchasing information.

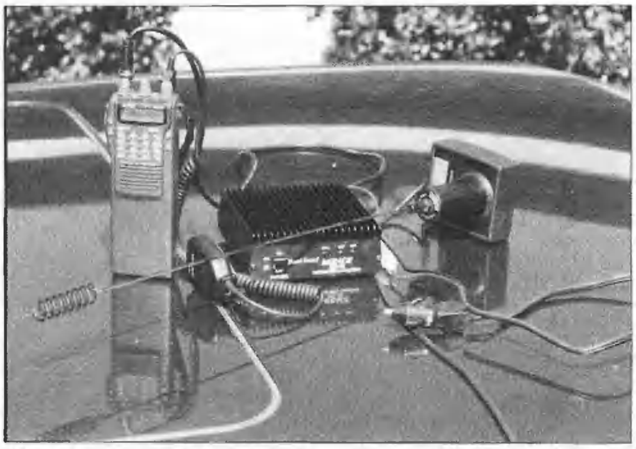


***Photo F.** The mobile* A-O-27 *station at W5ACM includes an Alinco DJ-580T HT with dual-band Mirage BD-35 amplifier and Larsen dual-band mobile whip (Model NMO 2/70 B).*

HAMSATS
continued from page 47

contacts were made during the four-day trip.

Reception on the Eggbeater was sometimes difficult while chasing the 70 cm downlink signals from *Fuji-OSCARs 20* and *29*, but was reasonable for most of the passes from *AMRAD-OSCAR-27*. For home use, this antenna might work better when placed in a high, clear spot. The stepladder only got the antenna about eight feet above the porch, while the two-meter Ringo Ranger was mounted above the chimney. We also caught a lot of fish.

In early June I had an opportunity to watch Keith Pugh W5IU, AMSAT Vice President of Operations, make a number of good contacts via *A-O-27*, using only a five-watt, dual-band HT and an Arrow dual-band hand-held beam. *A-O-27* provides a single-channel, Mode J (two meters up and 70 cm down) FM transponder that is active for daylight passes over North America. Keith's demonstration was part of the satellite seminar at the Arlington HAMCOM between Dallas and Fort Worth TX.

The Arrow beam's gain and easy maneuverability really helped both the uplink and downlink signals. The gain on 70 cm is greater than that on two meters, and the beam width of the 70 cm portion is narrower. When signals are best for 70 cm reception, they will be excellent for the two-meter uplink.

After Keith's demonstration I was once again excited about mobile and portable *A-O-27* contacts. Some of the distributors at HAMCOM had Maha MH-A201 dual-band power amplifiers on sale. The literature stated that they would allow full duplex operation, so that I could transmit on two meters while receiving on 70 cm with my dual-band FM HT. Power output on two meters was listed as 45 watts for three watts input. I was finally ready to buy, but they were all sold out. I then learned that the Mirage BD-35 dual-band amplifier was not only the same price, specifications, and appearance as the Maha MH-A201, but it was probably made in the same factory in Taiwan. A few were left, and I got one.

My mobile *A-O-27* station consisted of an Alinco DJ-580T HT, the new Mirage amplifier and a Larsen dual-band mobile whip antenna (Model NMO 2/70 B). During spare time on the Monday after HAMCOM I gave it a try. On the first pass a few brief contacts were made, but they were not easy. During the second satellite pass I tried moving the antenna around for best signal reception. This worked much better. Signal levels were up and the fades noted on the first pass could be avoided simply by adjusting the antenna's orientation. It was a lot like operation with the Arrow beam, but with less gain. A few Eggbeaters on the car might be a good experiment for next time.

VUCC

Contacts on the low-Earth-orbit satellites have changed over the years. They are still somewhat brief, but grid squares are second only in importance to callsigns. Some stations don't even bother with states and cities for the exchange, just grids. Interest in the American Radio Relay League (ARRL) VHF/UHF Century Club Award (VUCC) has found an attentive audience on the amateur satellites.

The satellite version of the award is given for confirmed contacts with stations in 100 different Maidenhead (two degrees by one degree) grid locators. All confirmed contacts must be made after January 1, 1983. Full details can be found via the Internet at the Universal Resource Locator (URL): [http://www.arrl.org/awards/vucc/]. The site describes the awards and the rules, and provides application forms for printing and mailing.

Many of the portable/mobile *A-O-27* enthusiasts have taken the time to go out to rare grids and make them available during satellite passes. This activity has also been noted on *Fuji-OSCAR-20* and *29*. Although the equipment (SSB and CW gear) is sometimes more bulky, expensive and complex than dual-band FM rigs for *A-O-27* work, there have been a few operators taking it on the road. Listen for them, or better yet, plan your own portable operation for your next vacation, camping expedition, or road trip.

Be sure to park the vehicle, if you are mobile, prior to making satellite contacts. It's bad enough avoiding those folks with cellular phones glued to their ears while they try to drive.

***Photo G.** Gary KD5DAY holds a dual-band Arrow beam while Keith W5IU gets ready for an* A-O-27 *pass at HAMCOM across the street from Texas Stadium in Arlington.*

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/
homingin/]

The Italian connection

English novelist Edward M. Forster wrote that a trip to Italy can be an education in how to live well. For the most part, he was right. April WA6OPS and I have just returned from 10 days there and our minds are still reeling with images of the beautiful artwork and architecture in cathedrals and museums, not to mention the great food. Unfortunately, we also experienced the world's worst traffic, or so it seemed.

The proudly displayed works of Leonardo da Vinci, Michelangelo, Donatello, and countless other artists are justifiably renowned, but many other Italians have had greater influence on the way we live our lives today. To radio enthusiasts, none can top Gugliehno Marconi (**Photo A**).

Marconi was not the first to transmit electricity through space using periodic oscillations. That was done by Heinrich Hertz in 1888, giving rise to the term "Hertzian waves." Marconi was age 14 and attending the Technical Institute in Livorno at the time. When he heard of Hertz's experiments, he began to dream of sending signals for long distances and making money at it. He already knew the Morse code, so the idea of a wireless telegraph for ships at sea was the next logical step.

Little Guglielmo spent hours reading about Hertz and others who were setting the stage for the advent of electronics and radio. Many of them were fellow Italians. For instance, zoologist Luigi Galvani had observed by accident that electrical waves could travel through space. As Galvani was testing an electrostatic machine, the hind legs of a frog several feet away began to twitch.

Augusto Righi had invented several radio wave sources and detectors at the University of Bologna. His shock-excited oscillators were two spheres spaced one-tenth of an inch from each other in paraffin oil, connected by inductors and charged by a spark coil. Although crude by today's standards, they were good enough to prove that light waves and waves at radio frequencies displayed similar properties.

Generating waves was important, but it was also necessary to have simple means to detect them. After all, it wouldn't be practical to equip all future receivers with frog's legs! Yet another Italian, Temistocle Calzecchi-Onesti, was the first to make a non-organic RF detector, called the coherer. It consisted of a small glass tube containing two electrodes and some metal filings. Sparks in the vicinity of the coherer caused increased conductivity (cohesion) of the filings. When the coherer's electrodes were wired in series with a bell and battery, detected Hertzian waves would cause the bell to ring. Unfortunately, it continued to ring when the incoming wave ceased, so the user had to tap it to release the cohesion.

At age 20, Marconi set out in earnest to achieve long-distance communication by electromagnetic waves. He convinced a professor at the University of Bologna to give him access to the physics library and laboratory, but he confined all his radio experimentation to an old attic, fearing that his ideas might be stolen and someone else would beat him to his goals. Though many of his early experiments failed, he persevered, creating more powerful oscillators and more sensitive coherers with automatic tappers. It's amazing that within three years he was able to make transmitters and receivers to cover 30 miles, considering that vacuum tubes, crystal detectors, and receiver tuning did not yet exist. Of course, receiving was easier for him because there were no other stations to cause QRM!

At the longwave frequencies of Marconi's early work, it became clear to him that the bigger the antenna system, the better. When he sent his first signals from England to France, the transmitting aerial had wires 150 feet high, extending across the English Channel, held up by lighthouses and naval vessels.

As every Big Gun DXer knows, "If your antenna didn't blow down last winter, it wasn't big enough." Sure enough, as Marconi's associates prepared for transatlantic tests in 1901, the large receiving antenna under construction in Newfoundland fell victim to a storm. Marconi immediately sailed to St. John's, where he replaced it with a 14-foot diameter balloon and trailing wire. The balloon was soon lost in a gale, whereupon Marconi launched a kite-borne aerial to complete the experiment.

The Bill Gates of wireless

Whereas most of the other radio pioneers were academic physicists, Marconi was an engineer and a businessman. His grades weren't good enough for him to become an enrolled university student, but he devoured books and spent countless hours of trial and error in his laboratory. There were many naysayers who insisted that long distance wireless was impossible because sunlight would create too much wave interference and that radio waves would not follow the curvature of the Earth.

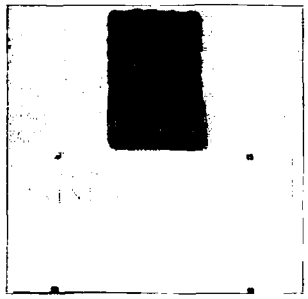


***Photo A.** Italians are proud of the accomplishments of Guglielmo Marconi and have erected many monuments to him. This one is in the Duomo Cathedral in Florence.*

Marconi simply ignored the critics. By 1910 he was DXing from Ireland to Argentina, and by 1918 his "countries worked" list included Australia. He deduced the inverse-square law of wave propagation, which led him to design ever higher powered spark transmitters. His early 24-watt rig got him two miles' range in 1896 and his first transatlantic transmissions were at 30 kilowatts, but he built 300 kW stations to provide reliability for his commercial transatlantic telegraph service that began in 1907. As technology developed, he moved his operations from longwaves to short-

Continued on page 52

***Photo B.** Shipboard CW operators aren't required nowadays, but the classic Bellini-Tosi dual-loop RDF antenna is still a common sight on vessels of all sizes.*

Homing In
continued from page 51

waves, which permitted much greater daytime range.

Marconi carefully protected his inventions and sought to make them commercial successes all over the world. This was facilitated by his strong connections to the British. Although he was born in Bologna, his mother was from England, and he spent most of his early years there, learning English first. His first radio patent was in London, where he formed the Wireless Signal and Telegraph Company (later changed to Marconi Wireless Telegraphy Company) in 1896. Then came the Marconi Company of Genoa, Italy. He traveled to the US in 1899 to perform wireless experiments with US Navy ships, forming the American Marconi Company while here. In 1919, General Electric purchased the Marconi companies of Britain and the US, forming the Radio Corporation of America (RCA).

Successful people become targets, and Marconi was no exception. When his transmissions spanned the Atlantic, it was a blow to the Anglo-American Undersea Cable Company of Newfoundland, whose shares on the London Stock Exchange dropped precipitously. AAUC sued Marconi for damages, claiming that his purported DX reception was an error or perhaps even fraudulent. Although the government of Newfoundland promised support to Marconi, he decided it was best for business to move his New World operations to Cape Cod.

Marconi continued to invent new wireless components such as the time-spark system for generating continuous waves and a magnetic detector that replaced the finicky coherer. He also used the work of other scientists to build his empire, when needed, by purchasing rights to their patents. He established the Radiotelegraphy Institute at Frinton in 1901 to train operators and technicians for the new wireless telegraphy industry.

As shrewd as he was at business, Marconi sometimes misread the market. Believing that CW would suffice for all oceanic communications, he ignored the possibilities of voice modulation. That gave others, including Lee DeForest of the US, an opportunity to pave the way for AM and the broadcast industry.

Direction finding in the early days

Marconi's early wireless aerials were large metal objects such as sheets and cylinders. In 1895, he discovered that connecting one terminal of his transmitter's output to the aerial and the other to earth gave improved range. He also found that wire antennas worked better than large metal surfaces and that they had useful directional characteristics. In July 1905, Marconi's longwave directional antenna (an inverted-L) was patented.

In his experiments on signals transmitted from the *H.M.S. Furious* in 1906, Marconi tried an electrically-rotated directional antenna system consisting of several inverted-L's in a star configuration. Since the L's were each only about one-fifth wavelength long and very close to the ground, the directional effect was not very pronounced.

Marconi observed that propagation and radio direction finding (RDF) conditions were greatly affected by signal frequency. "Shortwaves behave like short quick ripples which hit a rock and come back," he stated, "while longer waves go beyond the rock by going around it." Today's transmitter hunters know he was right. Multipath (signal reflection) degradation of RDF accuracy becomes much greater as frequency goes up.

It was two fellow Italians, Ettore Bellini and Captain Tosi, who took the next giant step in RDF technology. They expanded on the earlier work of Pickard, who had shown that a small, vertically-oriented loop antenna had an excellent directional pattern for ground-wave propagated signals, characterized by broad lobes off the ends of the plane of the loop and a sharp null "through the loop."

Bellini and Tosi mounted two loops together, oriented at right angles, and invented a special coupler to combine their patterns at the receiver input. This coupling device, called a goniometer, made it possible to rotate the directional pattern in azimuth without the loops themselves moving. This was ideal for use on ships (**Photo B**). Inductive coupling is still used on goniometers for longwave and shortwave, with fixed coils attached to the loops and a rotating coil connected to the receiver. Marconi's enterprise bought rights to the Bellini-Tosi system in 1912.

Historians claim that RDF came of age when Captain H.J. Rounds of the Marconi Company installed a chain of wireless stations on the coast of England. Operators are said to have used their RDF antennas to detect movement of German warships in May 1916. Britain's First Sea Lord, Sir Henry Jackson, then sent his fleet of 35 ships into action at the Battle of Jutland against 28 German vessels. The Brits suffered greatest losses, but they forced the German fleet to retreat to port, where it remained for the rest of that war.

Sir Henry credited the newly-installed RDF stations for detecting the movement that caused him to commit to battle. However, some historians believe that this was disinformation, intended to cover the fact that cryptanalysts had cracked the Germans' naval ciphers and intercepted messages to the U-boats about a rendezvous at sea. The code-breaking scenario appears more plausible, because the fleet's initial movements, over 300 miles from the RDF stations, would have changed their bearings by less than one degree. Whatever the case, the sensitive receivers and highly directional antennas of Marconi's installation made possible the interception of enemy transmissions.

RDF becomes a sport

Amateur radio operators in the US experimented with directional antennas from the early days of our hobby, mostly as a way of avoiding QRM. The September 1923 issue of *QST* announced a hidden transmitter hunt as a feature of the Second National ARRL Convention in Chicago, but RDF did not become an important activity for almost three decades.

In the late 1940s, announcements of several ARRL division conventions invited attendees to bring along crystal detectors and earphones so they could participate in the two-meter transmitter hunts. Judging by the number of *QST* magazine announcements, there were probably more hidden transmitter hunts at these conventions in 1948 than there will be at ARRL conventions in 1998. Apparently, a diode, earphone, and antenna wire were the only things needed to receive and track those signals. This was before my time (almost), so if you went on these postwar hunts, please write and tell me about them.

The 1950s brought a flurry of mobile T-hunting on 10 and 75 meters. Bulky batteries, tubes, and noisy dynamometers didn't keep hiders from concealing their Ts in picnic baskets and using fishing poles as camouflage whip antennas. By the 1970s, most transmitter hunting in the US was done in cars on two meters, taking advantage of smaller and more sensitive solid-state gear. Meanwhile, Europeans began doing their RDF contests on foot, first on 80 meters and later adding two-meter events.

Nowadays, organized on-foot foxhunting (also called radio-orienteering and ARDF) is a popular ham activity in most countries of Europe. However, I found very little of it in Italy. There is no national ARDF organization in place. The country's last ARDF coordinator passed away and a successor has not been named. A few stalwarts continue to participate and

ON THE GO

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[ke8yn@juno.com]

O.B.E.

Those of you with a military background may recognize the title of this month's column as the abbreviation for "Overcome by Events," or put another way, "The best laid plans of mice and men ..." I had originally planned on writing about a different topic, but some recent events have caused me to change directions.

Shortly before this column was written a single satellite malfunctioned; the malfunction knocked out many pagers throughout the country. It also affected other relatively routine functions—such as credit card payments at gas stations. It was surprising to see how far the ripples spread from a single problem with a single satellite. With our technology today affecting most parts of our lives and with the technology itself being so advanced, we are very vulnerable to large disruptions caused by the smallest malfunctions. If this is a taste of a small problem, what larger problems might be looming out there? How about the Y2K bug? As everyone knows by now, when the calendar turns to January 1, 2000, some computers which store the year portion of a date as only two digits will see the date as January 1, 1900. Although people have been aware of this problem for years, many business and government officials have been reluctant to put other plans and projects on hold to spend the money to correct this bug. If a stitch in time saves nine, this problem may require a major reweave to correct it, since we've done so little to date. Very few organizations are completely prepared, and this bug may affect everything from navigation aids for planes and boats to the programming of your VCR.

In the last few weeks it has become known that although many businesses have fixed the problem in their computers (which prepare bills), they have not addressed the problem with many embedded processors—those processors that are built into systems and equipment. As surprising as it may seem, many industries did not even think that this area would need attention, including many power companies and other utilities. As a result, the expectation now is that the electrical power industry fully expects to lose power for some unknown period of time when the millennium bug kicks in. They now say it is not a question of *if*, but a question of how bad, for how long? I suspect that if they are admitting this a year and a half before the problem will occur, the situation may be more serious than previously believed.

Talk about ripples! A major loss of power will create a significant series of additional problems. Naturally this will include loss of heating or cooling for many people, as well as the ability to store and prepare foods. One of the biggest headaches with any loss of power is traffic control when the traffic signals cease to function, increasing accidents, slowing traffic to a crawl—and, eventually, stalling entire cities in gridlock.

But what if the Y2K bug creates problems with the telephone system? Telephone service may be affected as many people attempt to use the phone system to check on friends and relatives or just to kill time. In addition, telephone systems are highly computer-dependent, and even if the major carriers address these problems, localized issues can be significant. Many business systems would be affected, of course, but what impact might we expect on the phone systems or the computers used at the 911 consoles—which normally direct police and fire responses? As I was wondering about these issues, I received a very interesting E-mail from Joe Moell KØOV, who made some comments about a previous column. I had suggested that hospitals might provide an avenue for disaster drills, but Joe pointed out that there are many smaller situations in which hams can be of assistance. Many hospitals use telephone systems which are computer-dependent and these could be vulnerable to any major problems such as Y2K. While hams may be called upon to help in such crises, there are many other opportunities to provide communications support on a more routine basis. The hospital phone systems need both software and hardware to be updated on a periodic basis, something often scheduled for the middle of the night to minimize disruption. While the upgrades are installed, the entire telephone system may need to be taken down. This provides an excellent opportunity for hams to be of assistance.

During the telephone outage, hams can be stationed at key locations where services may be needed, such as the Emergency Department, Intensive Care, etc. They also are stationed at locations which provide those services, such as laboratory, radiology, the blood bank, etc. Liaisons may also be assigned to the administrator on duty, or other key personnel. This allows the senior manager on site to monitor what activity is occurring, and how the needs are being addressed. If area hams assist local hospitals on a regular basis,

---

promote the sport, such as Francesco Lancellotta IK8VWA of Macerata. Plans for his rugged hand-held two-meter ARDF beam were featured in *73 Magazine* in May 1998.

Annual foxhunts are held in a few communities in northern Italy, but they do not follow international rules. "Transmitter power is only about ten milliwatts, and the foxes are usually less than 400 meters away," explains Piero IK2VTJ, who lives near beautiful Lake Garda. Organizers make sure that extra equipment is available so that visitors to these events can be introduced to the sport of ARDF.

T-hunting in cars is also done occasionally in some parts of Italy. IK2VTJ likes both on-foot and mobile hunts. In the tradition of his inventive countrymen many decades ago, he is building an electronically rotated RDF antenna system for his car. His goniometer is for two meters and uses switches instead of transformers. You can see it on his Web page, reachable via a link from our "Homing In" site.

Cheer for the US!

The time is near for the Tenth ARDF World Championships in Hungary, scheduled for the first week of September. Italy won't be sending a team, but about two dozen other countries will, and the US will be represented for the first time. Watch for the results and stories of the action in future "Homing In" columns. Meanwhile, keep sending me your RDF news, including results and photos of your local transmitter hunts, both mobile and on foot. Electronic and postal mail addresses are at the beginning of this article. Good luck on the hunt!

QRP

Number 54 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

When NorCal introduced the 38 Special, it was an instant hit. The club sold over 2000 38 Specials before production was halted. That's a lot of building and soldering!

What is the 38 Special?

The 38 Special is a small 30-meter superhet transceiver. It was designed by Ori Mizrahi-Shalom AC6AN. This rig really was an exercise in minimization. But more important, the 38 Special served as a base on which many, many modifications were installed.

An interesting aspect of the 38 Special is the lack of bunches of discrete transistors. Most of the "magic" of radio is done with the help of ICs—even the final amplifier used an IC.

Although the 38 Special is loosely based on the 40-9er, there are only two NE602 mixers used. A little magic with a 4066 allows one crystal mixer to be used either as the transmit mixer or the BFO for the product detector.

The 38 Special has an input filter and a brute force RF gain control to keep out unwanted signals. The front end is also where the T/R switching diodes are placed. There are no relays used in the 38 Special. It uses a VXO for controlling its frequency. By using a mix of design goals and off-the-shelf components, the VXO can swing about 20–25 kHz.

In keeping with the design goal of using off-the-shelf components, the IF filter consists of a single crystal with a handful of caps. Although a bit wide, it works for such a simple design.

The RF amplifier has an output of about 500 milliwatts. There are on-board pads and traces to install an optional five-watt RF amplifier.

Although the 38 Special was extremely popular. NorCal no longer markets the kit—so you're out of luck if you want a 38 Special.

The reason I wanted to give you an overview of the circuit is to help you follow along, because we're going to do some troubleshooting and repair on a 38 Special transceiver.

Right now, I'm working on a 38 Special that was given to me by a ham. Since I didn't build the rig myself, it has proven to be an interesting project.

Before we begin

Before we get started in the internal workings of the 38 Special, there is a new kit being produced by NorCal. Since the new one was scheduled for August release, it seemed like a good time to start spreading the word, so here is the info about the latest NorCal kit, the NorCal 20, supplied by Doug Hendricks KI6DS.

The NorCal QRP Club is pleased to announce its newest kit, the NorCal 20, designed by Dave Fifield AD6AY. The NorCal 20 is a 20-meter CW transceiver with the following features:

•Superhet receiver.

•TUF-1 mixer for the front end (designed for the harshest European conditions), *not* another NE602 front end.

•Variable output power from 0–5 W.

•VFO controlled, user bandwidth-selectable from 10 kHz to 200 kHz on any portion of the 20-meter band. This means that if you only want your VFO to cover 25 kHz of the band, you may set it up to do just that.

•Varactor-tuned VFO, 10 k pot supplied, but board laid out for 10-turn pot.

•Self-contained keyer, custom-designed for NorCal by Embedded Research.

•LM380N 2 W audio chip; easily drives a speaker.

•Frequency readout via audio frequency annunciator.

•A PIC chip is used as a frequency counter with audio output. In the automatic mode, as you tune the radio, a beep is generated every kHz. Then, when you stop, the last two digits of your frequency are announced in Morse code. You may also push a button to generate the frequency that you are on.

The manual mode does not have the beeps and you must push the button to get your frequency (designed by Mike Gipe K1MG).

•Custom clamshell case, made from .090 aluminum, four and a half by four and a quarter by two and a quarter inches, designed by Bill Jones KD7S, and made by Doug Hauff KE6RIE.

•All controls, knobs and connectors are supplied.

•Double-sided, plated-through, solder-masked, silkscreened board, commercial quality.

•Comprehensive manual, written in the "build-a-section, test-a-section" style.

•Five-pole crystal filter.

•220 board-mounted parts, no surface mount.

•Full QSK. NO relays.

•IRF510 final, 2N4427 driver.

Only 500 of these kits will be available, and orders will be accepted after August 1st. There will only be one run, and there will not be another. NorCal will no longer produce unlimited kits. The price is $95 for the kit, plus $5 shipping and handling in the US, $10 DX to Canada and Europe, $15 to Asia and the Pacific Rim. Payment must be in US funds only, and checks must be made out to Jim Cates, not NorCal. European members may order from NorCal's European agent, Stephen Farthing, and the price is £70 (70 pounds sterling). The kits will be shipped

---

it will be much smoother should they face a major problem. While it is true that during a routine switchover a handful of cellular phones could handle the situation, during a major communications problem, the cellular system may be affected as well.

Joe wrote how the Hospital Disaster Support Communications System (HDSCS) of Orange County, with 90 members, has been providing backup communications for hospitals for 18 years. This shows good interaction between hams and the hospitals, as well great preparation. Does your club or group plan on such eventualities? Now may be the time. Incidentally, if you're curious about this, check out the HDSCS Web site at [http://members.aol.com/emcom4hosp/].

With many phone systems so computer-dependent, and with computers subject to the Y2K problem, this is an area in which problems can be expected and amateur radio can be a help. The key is to get involved now with local hospitals to ensure that we know what we need to do and have the resources to do it if (?) and when we're needed. Does your club or group have a liaison with the local hospitals? Do they know how to contact the area amateurs?

I guess the key issue is that sometimes we spend so much time planning for the problems we know—tornadoes, hurricanes, blizzards, etc., we forget that as we progress, other disasters may be awaiting us. The Y2K problem is just one. In the past few weeks I've heard more disaster services folks speak of *La Niña* and its ramifications—including the possibility of tsunamis hitting the continental US. We've got our work cut out for us. 73

Number 55 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
P. O. Box 473
Stevenson MD 21153
[ajr@ari.net]

How do you describe Labor Day? On one hand, it represents the symbolic end of summer. On the other, it is the beginning of the school year. This time of year seems like a natural time to look for help and new ways to do things.

A time-honored tradition among hams is the "Elmer." This is an affectionate name for hams willing to help hams. In the days of widespread active ham clubs, finding such an individual was easy. Now, it's much more of a challenge.

Enter the Elmers Web site, on the Netmeg Internet service. Here you will find a long list of individuals who have offered to help in this way or that. In alphabetical order, you will find people willing to help with everything from basic ham radio topics through radioteletype, packet, amateur television, and other exotic topics. Check it out at [http://www.netmeg.net/faq/recreation/radio/ham-radio/elmers/].

Another fellow who has set out to help the online ham community is Andrew Tumanov, who has created the "raDioWavE" site. On this Web site you will find a full complement of links to a wide range of amateur radio resources, downloadable software, and special events. This one clearly belongs on your bookmark list. Take a look at this one at [http://www.estpak.ee/~andrew/index.htm].

A scholarly set of links was put together under the banner of "AmSoft—The World of Ham Radio's Missing Links." Well, they are not exactly missing, just missed by most hams on the prowl for information. Here is an authoritative text on phonetic alphabets, telegraph keys through the ages, hamfests, magazines, and more and more. You might find just what you are looking for at [http://hamster.ivey.uwo.ca/~amsoft/amsoft0.htm].

Is that it? Hardly! A British site is another with a long list of amateur radio links. This one is unique in its featuring of both British and specialty manufacturing sites. For your guidance, the URL of this site is [http://www.g4dvj.demon.co.uk/radio.htm].

Are all the sites of interest only in English? Of course not! Here is a site called *Kurzwelle*, that's "Shortwave" in German. The major feature of this site is

Continued on page 62

after Pacificon, with a projected shipping date of Oct. 20, 1998.

The exciting part of this project is that for every kit sold, NorCal will produce a second kit and send it to the G-QRP Club, which will handle distribution to hams in third world countries at no charge to the receiving hams. They will give the kits away! 500 kits sold equals 500 kits for third world hams. George Dobbs has been selected to handle the distribution of the third world kits because of his extensive network of contacts with hams in these countries. Every effort will be made to assure that the kits get to deserving hams.

This is a huge project, and one that has never been done successfully before. The NorCal has been designed to be easy to build with minimal test equipment, yet to be a quality radio capable of worldwide contacts when finished. Dave AD6AY has many years of experience of operating in Europe, and is very familiar with the requirements of radios in that environment. He has designed the front end with the operating environment in mind.

George Dobbs suggested last summer that NorCal come up with a way to provide kits for needy hams in third world countries—and they've done it. The NorCal 20 team of Dave Fifield, George Dobbs, Jim Cates, Mike Gipe, Doug Hauff, Gary Diana, Brad Mitchell, Bill Jones, Richard Fisher, Jerry Parker, Paul Harden and Doug Hendricks have worked very hard to ensure success.

Remember, no checks were accepted until August 1st, to be sure that everyone had a chance to learn of the project and had an opportunity to buy a kit. To order, please send your check and a self-addressed mailing label to:

Jim Cates
3241 Eastwood Rd.
Sacramento CA 95821

European customers may choose to send their orders (in British pounds sterling) to:

Stephen Farthing
38 Duxford Close
Melksham, Wiltshire
SN12 6XN
England

Wow! Looks like this is going to be a project and a half. If you want one, you had better order the kit as soon as you can. There will not be a second run made by NorCal.

Looks like I'm out of room, so next month we'll dig into the NorCal 38 Special. You might want to keep this issue handy, as it will be referred to as we work on the rig.

Number 56 on your Feedback card

Multibanding the Fracvert Half-wave

Here's a wire vertical with surprising performance on 40–10 m.

Chip Cohen N1IR
2 Ledgewood Place
Belmont MA 02178
[fractenna@aol.com]

In the search for a simple, high performance, multiband HF antenna, the choices are pretty limited. Topping the list is the G5RV, a dipole with a radiating ladderline section on some bands. I've never been crazy about the power pattern on this antenna and, given the fact that it needs a tuner, it struck me that other tuner options beyond a droopy longwire must be around.

Of course, the solution is often under your nose. Having spent considerable research efforts on fractal antennas, I decided to play with a very simple one. Fractal antennas are shaped antennas that are "bent" in some self-similar way. Each time you do a scale of bending, it's called an iteration. The effect is to produce something akin to linear loading, but on many scales of size. Fractal loading has proved an efficient way of making smaller antennas.

But another effect caused by fractal bending is phasing—and gain. The simplest example is when the bending is done on just one scale—effectively, a stub. Applying a three-sided box stub in the middle of a dipole yields a Cohen dipole, an echelon antenna optimized for performance using shaped antenna and fractal ideas. It is high-gain: over 4 dB when compared to a regular dipole. The tradeoff for this example is size, though. The Cohen dipole is one wave in its biggest dimension.

My Fracvert Half-wave is half a Cohen dipole, fitted as a monopole. It is a "try me" antenna: As a first-iteration fractal it was designed to get hams to think about the fractal possibilities. For those who prefer something more familiar than fractal geometry, its stub and echelon nature are adequate reasons for playing with it. And if those don't work, then the performance will. Gentlemen's bet: After you try this antenna, you will wonder what to do with your G5RV and dipoles and longwires. I can guarantee you that with 35 feet of height and a footprint of 35 feet for the radials, you will be extremely pleased with the results of your effort.

What does the antenna look like? It's a wire vertical with a dogleg. I show it in **Fig. 1** over eight radials cut for 20 m. For lengths in waves and feet, I've prepared **Table 1**. The antenna has a half wave of height on 20 m. It has full bandwidth and a flat VSWR on 20 m as shown in **Fig. 2** (all modeling done with NEC4), so if you scale the dimensions for 40 m, for example, you will get the same specifications.

Its gain was modeled over perfect ground with NEC4 (see **Fig. 3**), where ideally it shows over 4 dB gain over a quarter-wave vertical. It has gain over a half-wave vertical, too. But unlike the quarter- and half-wave verticals,

FracVert Dimensions for 20 m (14.15 MHz)		
Section	**Length (waves)**	**Length (feet)**
Feed Section (vertical)	0.17	11.8
Horizontal Section	0.25	17.4
Top Section (vertical)	0.33	23.6

Table 1. Fracvert dimensions for 20 m (14.15 MHz). All radials are 1/4-wave. All wires are #12 copper.

Photo A. Anchoring an elbow.

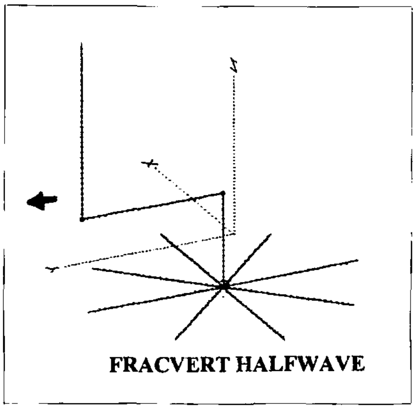


Fig. 1. The Fracvert Half-wave.

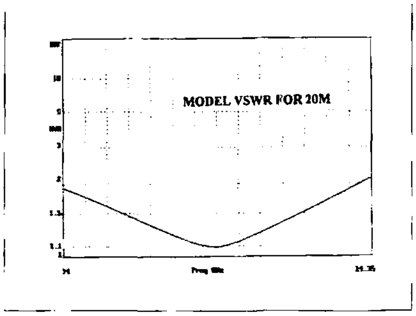


Fig. 2. Model VSWR for 20 m.

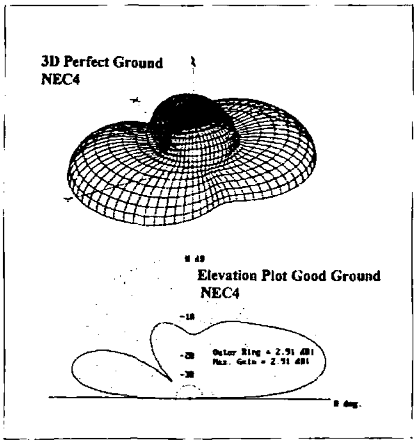


Fig. 3. NEC4 models.

Same Height Vertical Comparison

	Fracvert Half-Wave (20 m)		1/4-Wave Vertical (40 m)	
Band	Field Strength (dBi)	Az. Pattern	Field Strength (dBi)	Az. Pattern
40	-0.3	omni	-0.4	omni
30	0.1	Bi/omni	0	omni
20	2.9	Bi	0.7	omni
17	1.7	Bi	-0.5	omni
15	3.8	Bi (rotated)	3.5	omni
12	3.5	Bi (rotated)	4.3	omni
10	4.6	Bi	4.7	omni

Table 2. Same height vertical comparison.

this antenna's pattern is bidirectional like that of a dipole. Over real ground with good conductivity, the modeled pattern is a slightly asymmetric and bidirectional, also shown in **Fig. 3**, favoring the direction of the dogleg. View the Fracvert Half-wave as a very simple, resonant, coil-less, high gain vertical on 20 m and you already have a winner. And did someone say cheap? My costs were under $15, including ferrite chokes.

Brandishing an antenna tuner, more fun is to be had. On 30, 17, 15, 12, and 10 m, the antenna has practical gain over a quarter-wave vertical cut for those wavelengths. But as this is not a good comparison, I chose a 40 m quarter-wave vertical, equal in height to the 20 m Fracvert, and simulated its multiband operation. If you want to measure the better of two 35-foot verticals, this is a meaningful comparison.

Table 2 compares the quarter-wave vertical for 40 m and the Fracvert cut for 20 m. These field strengths don't include the insertion loss from the antenna tuner loading, but with a good tuner these losses will be minor and comparable for each of the two antennas. Note that I had to place the 40 m vertical over a much larger radial footprint, and the field strengths include losses over good ground.

What's clear from the data is that the Fracvert beats loading up a conventional vertical of the same height, often by a substantial margin. Furthermore, the Fracvert consistently has low takeoff angles (best for DX). Especially on 15, 12, and 10 m is this true; the higher gain numbers for the 40 m vertical are at moderate to high elevations and not useful for DX.

Some construction details are in order. All are no-brainers. One of the main issues at hand is how to support

the two "elbows." I did this by passing the wire through an insulator and anchoring the other end, as shown in **Photo A**. Another one is how to orient the antenna. On 20 m, the maximum gain is in the same direction (outgoing; see the arrow in **Fig. 1**) as the stub. On 15 and 12 m, it's at a right angle to it. I've indicated this as "rotated" in **Table 2**.

There are no tricks on feed attachment. Just make a radial harness and solder to the braid, and solder the center connector to the dogleg at the bottom of the feed section. Special note: Choke the coax with ferrite or a line isolator just to make sure that the coax doesn't radiate. The antenna is certainly unbalanced when not in use on 20 m, so a choke is imperative.

An intriguing possibility is true 80–10 operation for the Fracvert Half-wave. If the antenna is cut for 40 m and you have the 70 or so feet of height, then the antenna will work on all these bands.

The performance has been excellent with this antenna. I use it on 40–10 m as my default antenna these days (when not experimenting with others). In fact, I occasionally throw up its mate, with this second dogleg pointed 90 degrees off to get more coverage. I kick in the antenna tuner to match for all bands except 20 m, where the 1.2 VSWR is so good I just take the tuner out of line. My experience is that I typically beat tribanders at 35–45 feet with ease in the direction favored by the Fracvert Half-wave.

Of course, I'm not the only one who uses a Fracvert Half-wave. TT8JWM put up a Fracvert on 20 m last year and was "*very* impressed." About 100 hams so far have used them and sent me glowing E-mail. The antenna may be available commercially later (its patent is pending), but for now all hams are welcome to make their own and experiment with the multiband capabilities.

QRX

continued from page 8

meeting, ARRL President Rod Stafford W6ROD observed, "The debate was at times contentious and the result was not unanimous. Some board members preferred greater simplification; others were uncomfortable with some of the changes being proposed. However, every board member, without exception, left the meeting knowing that each of his or her colleagues did what they believe is best for the future of amateur radio."

Members are urged to contact their ARRL directors to comment on this proposal.

Forwarded from a Cornell (University) ARC Newsgroup bulletin by Shaun Gartenberg KB2JNW, via WA2YYX.

We'd Choose a Somewhat *Stronger* Word

On the night of 14 October 1996, the aircraft carrier *USS Theodore Roosevelt* and the cruiser *USS Leyte Gulf* were engaged in predeployment drills and tests off the Atlantic Coast. The *Roosevelt* was testing its Challenge Athena communications system, which was getting interference from the ship's radar system. At the same time, the *Roosevelt* was also testing its propulsion systems and conducting electric power shifts—which caused communications gear to cease operations at times. Part of the propulsion system tests included putting the engines astern for long periods of time.

The *Leyte Gulf* was trailing the *Roosevelt* at a range of about 4,000 yards, and had not been informed of the tests being conducted on the *Roosevelt*. Because the communications systems on the *Roosevelt* were not able to be used, the two ships were using flashing light to exchange messages—a method used in yesterday's navy, but apparently a lost art today. It took 25 minutes for one message to be received and passed on to the bridge. Flashing-light messages are sent using Morse code, and the text of the message that was received was garbled.

At 2:44 A.M., the *Roosevelt* went to "Emergency Back Full" on its engines and was going astern at 17 knots. At 2:49 a signalman aboard the *Roosevelt* started to send a message that said, "My engines are astern." The *Leyte Gulf* had not been told of this maneuver and the officer of the deck was confused by the movement. After recognizing the danger that was approaching, the *Leyte Gulf* also went to "Emergency Back Full" on its engines, but it was too late to avoid a collision. The *Roosevelt* and *Leyte Gulf* collided at 2:52 A.M. The result? *Over $10,000,000 in damage* to the two ships. Fortunately, there were no deaths or serious injuries involved.

The Board of Inquiry results stated that 25 minutes to deliver one message by flashing light using Morse code was "unsatisfactory."

TNX Jack R. Main W4YCZ. This appeared in the May 1998 issue of the *W8KEA Midland ARC* newsletter, Judy Engel KB8WEE, editor, but we got it from the *ARNS Bulletin*, June 1998 issue.

NEVER SAY DIE

continued from page 39

no longer taught, and there often is no documentation. This means searching through hundreds of millions of lines of code, a task that many companies have been putting off because of the expense.

But how can a large business, that depends on its mainframe computer every day, shut it down for the needed repairs? Worse, once the repairs to the software have been made, then comes the testing and debugging, a process which normally takes longer than the original writing of the code.

According to North, not one of our power companies is yet Y2K compliant. So how can programmers do the needed software repairs without electricity? Uninterruptible power units use batteries, which are okay for a few minutes, but not for days. Some systems may have gasoline or diesel generators, which is fine as long as they can keep getting fuel.

If you start reading the Web postings on the subject, you'll find that knowledgeable analysts and programmers are moving from the cities to places where they can live self-sufficiently. They're buying small farms, stocking up on food, making sure water is available, and putting aside a bunch of small bills for when the ATMs stop working. Having lived in New York City for over 30 years, I can imagine what it could be like with no electricity, no water, no sewer, no food, and every highway out of the city blocked with cars that have run out of gas. That's when bicycles could be sold for thousands of dollars.

Y2K Continued

Endless experts in the software field are telling us that much of the world is going to suddenly stop when the computers, which are running almost everything these days, suddenly stop. Our country's and the world's banking systems are not "compliant." Our power companies ditto. Without power or money our food supply system will stop. Without fuel our farms will stop producing food. Without trucks or trains the entire country will grind to a halt.

Knowledgeable programmers are busy packing up and leaving the cities and moving to small farms.

Having had several software companies, I know from personal experience how long it takes to debug software. My rule of thumb, learned the hard way, was to multiply programmer estimates by seven. A recent survey showed that on the average, successful major software projects run 25.8 months behind schedule — with 65% of them having to be canceled, mainly due to unresolved bugs. The industry estimate for checking new software runs to about 125% of the time needed to develop it initially.

So here we are with a date bug that could crash most of our older computer mainframe systems. Many of the programs were written in Fortran, Cobol, Assembler, and other mostly long-forgotten languages. The fix is to go through every line of code looking for any date references and calculations. We're talking about millions of lines of code for most larger companies.

How much do you pay a programmer to learn how to cope with an old language, work like hell for the next year doing mind-numbing line-by-line work, and then get laid off when the job is done?

When the lights, water, and food are turned off, what will the people in our cities do? And maybe turned off for months to years? With most businesses and factories closed down, including the banks, there's no income, nor any real prospect of it. Without banks, what value will money have? The banks don't have any cash anyway. Their business is lending out your money for mortgages, but all the data on who owes what will be tied up in their shut-down computers.

If everything suddenly stops on January 1, 2000, will you have enough food and water to keep you and your family alive? And if someone less provident comes with a gun, you won't be able to dial *911*. Plus, the police won't have any gas for their cars anyway.

I'm hearing from more and more people who have recently left the cities and moved to New Mexico, Arizona, Idaho, southern Colorado, Montana, New Hampshire and Vermont.

Now, is Wayne exaggerating? Before you dismiss the problem, do some of the homework I have. Talk with some people who are experts in software. With today's network of computers, all it takes is one crash somewhere and the dominoes will fall. Remember when a glitch in Canada brought down the whole eastern power system? For hours?

I can remember when insurance companies had whole floors of people at their desks with calculators. Now it's all done by a few people and a mainframe computer. Their programs were developed by now long-gone software houses.

Hmm, maybe I should start raising chickens again here on our farm. Just in case.

Bargain!

A couple years or so ago I reviewed the Graham Hancock book, *Fingerprints of the Gods*, and added it to my list of books you're crazy if you don't read. Hancock has done a magnificent job of visiting the sites of ancient civilizations and writing about them. He ties together

the folk tales from the people in these areas into a story of an ancient cataclysm which wiped out most of the Earth's civilizations, including the possible burying of Atlantis beneath the Antarctic ice.

His well-researched material on the pyramids and the Sphinx will give you endless conversational fodder. Well, it will *seem* endless to your friends or to anyone you can con into listening to you on the air.

The 578-page hardcover book was a bargain at $27.50, but here's the big news — I found the $17 paperback edition remaindered at Building 19 for $5. Wow! Check your local stores that carry remainders and grab this one, if you see it. It's a great read — a historical detective story.

Quiz

A high school buddy I keep in touch with, Chuck Opitz WA3YQV, sent me the following quiz. Let's see how you do. (1) How many birthdays does the average man have? (2) Some months have 31 days; how many have 28? (3) How many outs are there in an inning? (4) Divide 30 by 1/2 and add 10. What's the answer? (5) If there are three apples and you take away two, how many do you have? (6) A doctor gives you three pills, telling you to take one every half hour. How many minutes would the pills last? (7) How many animals of each sex did Moses take on the ark? Give up? (1) One. (2) All. (3) Six. (4) Seventy. (5) Two. (6) Sixty minutes. (7) Moses? Perhaps there's much to be said for letting go of old friends.

Weather

The black fly season was mercifully short this year, but I've never seen the mosquitoes in such swarms. It's more like when I was working in Florida and I'd park my car as close to the door to the radio station as I could and sprint for it. Maybe 10 seconds later I'd be inside, slapping at the mosquitoes that had landed on me. That's when I was working as an engineer-announcer at WSPB in Sarasota.

We've also been having the worst thunderstorms in my memory, and my memory goes back a lo-o-o-ng way. It's been raining almost every day, so mowing and getting in the first growth of hay from our pastures wasn't possible until the first of August! The grass was almost hip high. But, on the other hand, the wildflower display was spectacular. My daughter Sage and I enjoyed the display the other day. Golly, I wish you could get up here to New Hampshire for a visit!

All this is a reflection of the changes our world is going through. The *El Niño* rains. The tornado in Antrim, just over a mile away. The fires in Florida. The increase in earthquakes all around the world, and the volcanoes. An astronomer the other day said that he's never seen the Sun active the way it has been recently.

It's amazing how things are connected. The hundreds of new volcanoes under the Pacific Ocean have heated it up, giving us the *El Niño* rains, and they, in turn, have produced the bumper crop of mosquitoes. Hmm, now what started all those volcanoes acting up? Was it underground nuclear tests or the Sun?

Our 70 cm Band Challenged

The Land Mobile Communications Council has petitioned the FCC to take away two-thirds of our 450 MHz band. Maybe they got the idea from the ease with which commercial interests were able to get a big lump of our 220 MHz band. The present use of the band on a primary basis by radar may be enough to hold it for us. We'll see whether the military and other radar-using agencies have more clout than the land mobile lobbyists. We're kind of

LETTERS

continued from page 6

free-running clock, with a few seconds error per day that is reset at midnight with a one-second error. Traditional electric clocks using synchronous motors have about an order of magnitude smaller error.

The receiver tuned to WWVB has an insufficiently small antenna, so that in fringe reception areas, such as the West Coast, it must be placed in a window facing Colorado to receive the signal with enough SNR to function.

RTTY LOOP

continued from page 55

listing frequencies of interest to those who like to scan for various utility and commercial services. This information may be had at [http://www.frankfurt.netsurf.de/~mike/hf.htm].

Or the Scandinavian Amateur Radio Teleprinter Group. Presented in, well, Scandinavian (Swedish? Danish?), this is a source of help to the radio amateur that also includes listings of hams willing to lend a hand. I can't translate it, but at least some of it is recognizable as jargon. You be the judge at [http://www.plea.se/sartg/].

An Italian site which catalogs an assortment of ham radio resources, including those specific to radioteletype, packet, and other exotic modes, runs under the name ARI - Altri WWW. This one can be figured out, even if you don't know Italian! See if you can read it at [http://www.telemar.it/mol05/ari/html/altriwww.htm].

An ambitious amateur project, complete with the institution of ham radio banner advertising, is K1DWU Dot Net. Amateur radio news, links, and other information is presented in a clean, functional site. You should find something interesting at [http://www.k1dwu.net/].

Ian Kluft KO6YQ tells the tale of how he started collecting links, and ended up with an encyclopedic listing of amateur radio on the Internet. With a listing in table-of-contents format, hot links to the sections, and full URLs spelled out, this listing is easy to search, and easier to use. I highly recommend it if you are looking for that special information about some aspect of amateur radio. See if you agree at [http://www.kluft.com/~ikluft/ham/list.html].

Winding up our tour, Steve WA7YAZ has a visually appealing page that supports a great deal of ham radio information. From lists of ham radio magazines on line to hot links into the amateur radio newsgroups, this is a very interesting site. Make sure your browser is set up for newsgroups, though, or you will crash if you select one. See what I mean at [http://www.utw.com/~yaz/wa7yaz.htm].

By the way, a word about some of these URLs. Many of the site addresses on the World Wide Web include the *tilde* character (~). It is very important to notice when that character appears, use it correctly, and don't substitute a hyphen (-) for it. Many of the E-mails I receive stating that this or that published Web address was wrong involve a misplaced *tilde*. A word to the wise ...

Ribbons

Now, a few months ago, we were looking into the topic of ribbons. A variety of techniques, from stamp pad ink to WD-40, were suggested to re-ink or prolong the life of teleprinter ribbons. I received a letter from Jim KcKelvy W9DJN of Medina, Tennessee, who addresses the point with authority:

"Trying to ink ribbons with such chemicals as WD-40, stamp pad ink, and glycerine are, at best, a poor substitute for the *correct* ink."

Computer Friends, of Portland, Oregon, is one source he located. He further advises:

"They have the proper lubricated ink in various quantities. A two-ounce bottle will ink many ribbons.

"I have been inking ribbons for several years. In fact, this document [the letter he sent me with nice, dark, type] is being printed on a dot matrix printer with an Epson ribbon that has been inked several times.

"Application of the ink is another story. The above source sells a ribbon inker. This device consists of a small motor that pulls the ribbon past an ink metering well. In my case, it takes about 12 minutes to ink the ribbon. The motor shaft accepts various adapters to accommodate different ribbons.

"I understand there were commercial inking devices that one could attach to the teleprinter. I never used one, but see no reason the above mentioned ink would not work out.

"At some hamfests I have seen vendors selling small bottles of ink for ink jet printers. DO NOT use this ink. It does not have the proper viscosity.

"I agree with your assessment of cotton *vs.* synthetic ribbons and the comment about cellophane. But, if the ribbon material is still good, just ink those old surplus guys."

Computer Friends has been in business since 1982. In their words, the first product made was the MacInker, a universal ribbon re-inker, of which they have sold over 350,000 units to date. Ironically, the product name had nothing to do with the Macintosh. With a dash of optimism they had dreamed of being able to produce a banner (one day) reading "Over 100,000 sold," after the fashion of a well-known fast food franchise. They have expanded their lines, though, and now sell much more than that early product. You can contact them at:

Computer Friends
13865 NW Cornell Road
Portland OR 97229
Ordering: 1 (800) 547-3303
Tech Support and Questions: (503) 626-2292
[http://www.cfriends.com]

Just be sure to tell them that you read about them right here, in *73 Magazine*'s "RTTY Loop," OK?

Activity on the Web site slowed down over the summer, which I had expected, but is picking up now that fall has arrived. We plan to do some housecleaning and upgrading over the fall, with new items being added and older ones taken down. Check the site at [http://www2.ari.net/ajr/rtty/] and see if anything up there takes your fancy! Let me know what you like, what you dislike, and what you'd like to see. I'll see if I can accommodate you. Check back here next month, for more from "RTTY Loop," the original source for RTTY information.

---

like remoras, just going along for the ride and picking up any leftovers while the sharks eat.

Peoria

If you're within hard driving distance of Peoria and aren't there on Saturday, September 19, for my talks, I'm going to find it very difficult to forgive you. And never mind that blessed to forgive baloney. I'm going to hold a grudge, and if I don't get over it in this life, I'll nurse it for a lon-n-ng time in whatever comes next. Do you really need that kind of bad karma? Heck, life is tough enough as it is.

None of that shifty-eyed weasling — just be there. And bring some money so you can buy the books I've written that you should have sent for, but haven't. Bring lots of money.

One more thing: If you're enjoying my writing, give me a big hug. Okay? You don't want me getting discouraged, retiring and taking up golf, do you? Thin chance.

PROPAGATION

Number 63 on your Feedback card

Jim Gray W1XU/7
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

September 1998						
SUN	MON	TUE	WED	THU	FRI	SAT
		1 F	2 F-G	3 G	4 G	5 G-F
6 F	7 F	8 F	9 F-G	10 G	11 G	12 G-F
13 F-P	14 P	15 P-F	16 F-P	17 P	18 P-F	19 F
20 F	21 F	22 F	23 F	24 F	25 F-G	26 G
27 G	28 G	29 G	30 G-F			

As this forecast is being prepared (early June) the solar flux values are staying consistently in the range between 90 and 120, and the bands reflect this by producing good DX. There is every reason to suspect that the upward trend has now begun, and by September (this forecast) you can expect even better DX opportunities with stronger signals on good days.

As the calendar shows, the very best days (G) are likely to be the 2nd–5th, 10th–12th, and 26th–30th. The poor (P) days are likely to take place between the 13th and 18th and I expect the 16th, 17th, and 18th, specifically, to present other geophysical upsets as well, possibly in the form of violent weather.

10–12 meters

Fairly good transequatorial DX should occur during local afternoons. Also, some F2-layer openings on east-west paths to Africa and the South Pacific may be possible in the morning. Short skip out to 2000 miles or so ought to be available in the afternoon.

15–17 meters

Reasonably good DX to all areas of the world, especially to Africa, South America and South Pacific during daylight hours and peaking in the afternoon. Short skip openings to distances greater than 1000 miles should be common.

20 meters

Expect openings to all areas of the world from morning to evening (see band/time/country chart), peaking locally an hour or so after sunrise and again during the afternoon. Short skip beyond 750 miles should be good during the day.

30–40 meters

Fairly good worldwide DX openings may be expected from early evening through sunrise, short skip from 100 to 1000 miles during the day, and beyond during darkness hours. As always, QRN can be a problem, but should be abating this month.

80–160 meters

On 80 meters, you may find fairly good DX openings to the southern hemisphere during hours of darkness and sunrise, short skip to about 350 miles during the day, and out to between 500 and 2000 miles at night. On 160 meters, look for DX during the hours of darkness and just before dawn. Short skip should be available from 1500 to 2300 miles at night.

When reading the band/time/country chart, remember that a higher or lower band at a particular time, to a specific country, can produce good results. W1XU/7.

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
EASTERN UNITED STATES TO:												
ALASKA	15	20					20	20				15
ARGENTINA	20	20	40	40						10	10	15
AUSTRALIA	15		20			40	20	20				15
CANAL ZONE	15	20	40	40	40		20	20	20	10	10	15
ENGLAND	40	40	40	40			20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20			10	10/15
INDIA							20	20				
JAPAN	15	20					20	20				15
MEXICO	15	20	40	40	40		20	20	20	10	10	15
PHILIPPINES							20	20				
PUERTO RICO	15	20	40	40	40		20	20	20	10	10	15
RUSSIA (C.I.S.)	40	40						15	15	20		
SOUTH AFRICA	20								15	15	10	20
WEST COAST	40	80						20	20	20	15	40
CENTRAL UNITED STATES TO:												
ALASKA	15											15
ARGENTINA	15	20	20	40	40						10	15
AUSTRALIA	15	20	20	20		40	80					15
CANAL ZONE	15	20	20	40	40			15	15	10	10	15
ENGLAND		40/80	40/80			15/20	15	15	20	20	20	
HAWAII	15	20	20	40	40	40	80	20			10	15
INDIA								20				
JAPAN	15											15
MEXICO	15	20	20	40	40			15	15	10	10	15
PHILIPPINES	15	20						20				
PUERTO RICO	15	20	20	40	40			15	15	10	10	15
RUSSIA (C.I.S.)								20	15	20		
SOUTH AFRICA	20									15	15	20
WESTERN UNITED STATES TO:												
ALASKA	10/15	15	15	20	20	20	40	40				15
ARGENTINA	10/15	20	20	40							15	10/15
AUSTRALIA	10	15	15	20	20	40	40	40	20	20	15/20	15
CANAL ZONE	20	20	40/20	40/20	40			20	15	15	10	10
ENGLAND										15/20	15-20	
HAWAII	10	15	20/15	40	40	40	40	40		20	20	20
INDIA	15/20	15/20							20			
JAPAN	10/15	15	15	20	20	20	40	40				15
MEXICO	20	20	40/20	40/20	40			20	15	15	10	10
PHILIPPINES	15/20	15/20		20		40	40		20	20		15
PUERTO RICO	20	20	40/20	40/20	40			20	15	15	10	10
RUSSIA (C.I.S.)									20			
SOUTH AFRICA	20	20								15	15	20/15
EAST COAST	40	80						20	20	20	15	40

HAM HELP

Number 63 on your Feedback card

We are happy to provide Ham Help free on a space-available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double-spaced, on a full 8-1/2 x 11-inch sheet of paper. Use upper- and lowercase letters where appropriate. Also, print numbers carefully. Specifically mention that your message is for the Ham Help column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Massachusetts mystery

I am looking for information on a Grundig radio built for the Americas. It is shortwave, AM, FM and stereo. I would like to know who fixes them or knows of a source for leftover new parts. Is there a Grundig club? The model number is RF 2600/ Stereo, FM 13 circuits, solid state AM 7 circuits. The address on the radio is Grundig Werke GMBH Furth/Bayern, W. Germany. *Kris Hermanson, P.O. Box 273, Westminster MA 01473.*

73® Amateur Radio Today

International Edition

OCTOBER 1998
ISSUE #457
US $3.95
CANADA $4.95

Reviews:

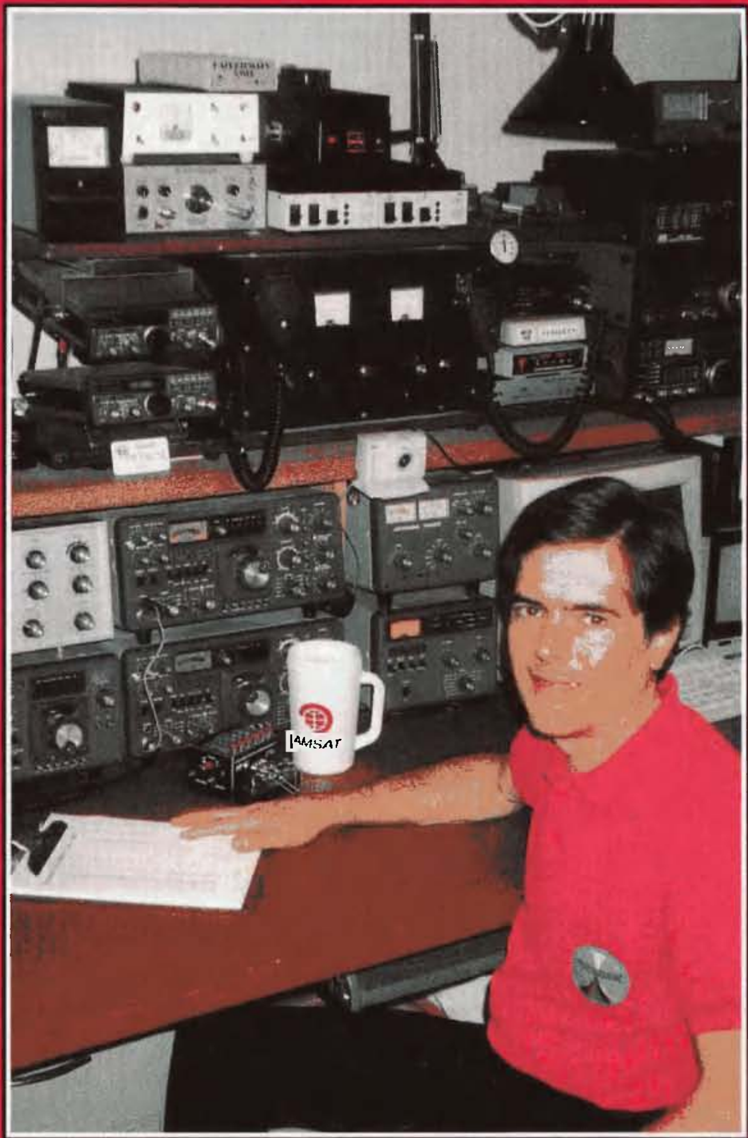
MFJ's Linear Protector

Scratch That Itch With The Embedded TiCK

Theory:

Matching Networks

Superhets Exposed



Andy MacAllister W5ACM

The VK-ZL All-Ham RV Tour

10

THE TEAM

El Supremo & Founder
Wayne Green W2NSD/1

Associate Publisher
F. I. Marion

Associate Technical Editor
Larry Antonuk WB9RRT

Nitty Gritty Stuff
J. Clayton Burnett
Priscilla Gauvin
Joyce Sawtelle

Contributing Culprits
Bill Brown WB8ELK
Mike Bryce WB8VGE
Joseph E. Carr K4IPV
Michael Geier KB1UM
Jim Gray W1XU/7
Jack Heller KB7NO
Chuck Houghton WB6IGP
Dr. Marc Leavey WA3AJR
Andy MacAllister W5ACM
Dave Miller NZ9E
Joe Moell KOOV
Steve Nowak KE8YN/5
Carole Perry WB2MGP

Advertising Sales
Frances Hyvarinen
Roger Smith
603-924-0058
800-274-7373
Fax: 603-924-8613

Circulation
Linda Coughlan

Data Entry & Other Stuff
Christine Aubert
Norman Marion

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

OCTOBER 1998
ISSUE #457

73® Amateur Radio Today

TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS

On the cover: Andy MacAllister W5ACM (ex-WA5ZIB) has been writing our Hamsats column for over 10 years. He is currently a member of the board of directors of AMSAT, the Radio Amateur Satellite Corp., and also serves as their vice president of User Services. His ham radio activities got their start when his father brought home the December 1966 issue of *73 Magazine* while they were living in Tehran, Iran. Licensed since high school, he holds an amateur Extra Class ticket and is an electronics design engineer and professional writer. His radio interests range from VLF to microwaves and CW to high-speed digital, but tend to focus on modes and activities via satellite. Photo by his XYL, Heather MacAllister.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

Never say die

Wayne Green W2NSD/1

Nothing To Say

If you believe that, I've got a zero-point energy device to sell you. I'm talking (well, writing) about the ARRL board's restructuring proposals. Jeez, they've actually come down from the 20 WPM code requirement for the Extra Class license. Well, Class A, they want to call it. I'm old enough so I used to *be* a Class A licensee. Old? You bet! I was making CW contacts on 40m in 1938. Lordy, that's 60 years ago! And I was on 160m phone, too. By 1941 I was able to win the Sweepstakes contest for my division. To prove it, I've got a medal that the ARRL sent me at the time pinned to my hamfest hat.

For you young squirts, back befo de wo we had three license classes: A, B, and C. Around 90% of us were Class B, which permitted CW on all bands and phone (it was 100% AM in them thar days) on 160m and 10m. Ten was like a VHF band and peopled by pioneers. Yeah, there was a little bit doing on 5m and 2-1/2m, but not much. So naturally I was attracted to 2-1/2 meters. Indeed, when I got my ticket, I made my first contact with Dexter W2MCV with my 2-1/2m walkie-talkie.

Most of my activity was on 160m phone, which went from 1800–2050 kc in those days.

Class A provided phone privileges on 75m and 20m. 100 kc on each band, so with AM carriers filling 10 kc, that allowed around nine roundtables. Period. Naturally the nine channels were dominated by nine kilowatt stations. When Irving Vermillia W1ZE, Cape Cod, came on, with his walloping signal and his ticking clock up near the mike, you knew who it was immediately.

That was then, and now is now.

My response to the League's timid approach to restructuring is restrained applause. It's better than doing nothing and watching the hobby go down the toilet due to the League's neglect. I think I'll still hear the toilet flushing — just not as loudly. Too little, and maybe even too late.

They've proposed to lower the code requirement for General from 13 per to 5. Using my sneaky (but legal) secret system, almost anyone should be able to ace the 5 WPM test with one hour of training. And that's for the slo-o-ow learners. Most people can be ready in about 20 minutes. Heck, I learned the Greek alphabet in 10 minutes when I was being hazed for my college fraternity initiation. It was either that or get my butt seriously whacked. And I still can rattle it off.

I learned the code one night while I was getting into my Boy Scout uniform. I'd put it off until a half hour before the meeting. I still know most of the code.

I won't rehash my judgment that the ARRL's 1963 incentive licensing scheme was not just a failure, but provoked the greatest disaster the hobby has ever experienced.

Look, you ARRL director guys (and gal), the future of the hobby is in your hands. It's time to make some major changes, not just patch up the leaks.

It was nice to see them propose widening the phone bands. Well, considering the withering away of CW activity, it's about time to reallocate frequencies. Heck, when I started, 40m went from 7000–7300 and was wall-to-wall CW, from top to bottom. 80m, from 3500–3900 was packed solid at night with CW. Now I hear a few chirps around the bottom of the band.

Motivation

Harry Lewis W7JWJ was kind enough to send me a long and fascinating letter. I might even have published it, but he asked me not to. I'll bet he was worried about his reputation being tarnished by being associated with weird Wayne Green.

Harry has a certificate for copying code at 79 WPM. He's offered $1,000 to anyone who could beat him at copying the code. He's taught thousands of people to copy the code. He points out that it has been taking longer and longer for people to learn to copy the code at 13 WPM. In the 1930s, it took an average of 12.5 hours of practice. By 1944, it was taking about 28 hours. By 1970, it was averaging 70 hours. It is now averaging 110 hours!

Harry is convinced that diet is a big part of the problem. Well, I agree with him that the American diet has gone to hell in a handbasket. Sugar, chocolate, white flour, meat laced with hormones and antibiotics, and so on. Smoking, beer and other poisons aren't speeding up our brains any, either.

Sure, our schools are part of the reason SAT scores have been plummeting, but so is the great American diet of hamburgers and fries, which provides virtually no usable nutrition for our bodies — or brains. We wash down the hamburgers and fries with a coke or a glutinous shake — both poison.

If you or your children want to be able to think and be healthy, you've got to shop a different part of the supermarket. Over there in that tiny organic food section, buying fruit and vegetables, instead of in the meat section.

Motivation helps, too. Harry noticed that when military ops had the choice of learning to copy code at 40 WPM in two weeks and getting a cushy safe job with good pay *vs.* going to an active battalion, they had a 100% success rate. Makes sense.

I've found that concentrating on building a new skill makes it easy and fun to learn. The old never-say-die approach. When the Advertising Club of New York had a horseback riding outing I remembered how much fun I'd had as a kid in Washington (DC) riding in Rock Creek Park, so I decided to take lessons. I found a superb professional and took lessons several times a week — until I got very good at it. I read every book I could find, got an Arabian, and started training him. I rode horses everywhere I went — on the beaches and hills of California, the forests of Germany, the beaches and hills of Caribbean islands, the parks of Paris.

When the head trainer at the Ringling Brothers stables in Sarasota saw me riding one of their horses he asked me to exercise his top show horse, Starlit Night. Wow! Now that was fun! I put the horse through all the *dressage* gaits. The horse was amazingly responsive to my every signal, no matter how slight.

Outside of my usual bragging, what I'm saying is that you can accomplish just about any skill you want to if you make it your business to do it. It takes motivation and determination. Never Say Die! With

that, a good diet, and plenty of exercise, you can beat Harry at the code — if you really want to. You can certainly yawn through the stupid 20 WPM test. And you can learn *any* skill you want to.

I'd like to see our schools devote more effort to teaching kids skills — like swimming, diving, bowling, bicycle riding, driving, flying, archery, etc. I've published a list of skills in the past, so I won't do it again. But how about you? Can you keep up with me on skis? Have you learned how to hot air balloon? Stunt kite flying? Juggling? How about parachuting? I'm game, if you are. Scuba diving? Let's see if you can use less air than I do. I guarantee you can't.

In what skills or fields are you an expert? Have you learned anything you could write about and sell your teaching? That can be a nice home business. I've become an expert on nutrition and my book *The Secret Guide to Health* is selling like crazy. As one of the founders and first secretary of American Mensa, I wrote *The Secret Guide to Wisdom*, which has sold thousands of copies. And, with a Ph.D. in entrepreneurial science, plus a lifetime of experience, my book *The Secret Guide to Wealth* is also a best-seller. So what have you done or learned that you can write about? Get busy with your word processor.

Oh, yes — please stop whining about the crummy code and just *do* it.

Stub-bor-en

Why are you so stubborn? My patience is over 17% exhausted just trying to get you out of the endless maze in which you've been trapped all your life. Despite everything I've been preaching, you have been stubbornly refusing to even consider starting your own business. What does it take to blast you out of the sand trap of a nine-to-five? Have you got iron-poor blood?

Sure, I got sucked into going to college so that I could work for other people all my life. It wasn't until I was 28 that I managed to wake up. That's when I started my first real business — manufacturing loudspeaker enclosures. I set up a desk in one end of my bedroom in Brooklyn (NY) and hired Jordan Polly K2AZL as my first employee. The manufacturing was contracted out and one end of the cellar was set up as a shipping department. Next to the coal bin and laundry tubs. My ham shack filled the rest of the cellar. This grew within three years to about a $20 million business, but by then I'd had to rent outside offices and a warehouse.

My grandfather had run his brake lining business from the same house twenty years earlier. He'd made millions inventing things, helping what is now known as Citgo get started with his college buddy Henry L. Dougherty. Dougherty put the profits from manufacturing my grandfather's inventions into oil. Then came the stock market crash and a million dollars in City Service stock dropped to being worth about $3,500. And my grandfather (Pop) went from being a millionaire to needing to find something to do to get by.

He first took over the management of Continental Can and rescued it from bankruptcy. Then his uncle called, explaining that he'd invented a new and better brake lining. Pop drove out to East Brady, Pennsylvania, to see what this was all about, and signed up to handle the eastern part of the country for Rex Hide brake lining. Customers loved it because the stuff didn't wear out every few thousand miles like the regular lining. Soon the cellar was filled with inventory and trucks were picking up shipments every day. The lining was molded out of carbon and rubber to fit brake drums, so when WWII came along and rubber was scarce, the factory was closed down. And that was the end of Rex Hide.

Pop, who smoked a pipe and cigars, died of pneumonia in his early 50s. Smoking had ruined his lungs.

Where am I heading with all this? I'm trying to get you to start thinking in terms of starting a small business in some field that will be real fun for you and run it out of your home until it gets too big to handle.

I started *73 Magazine* out of a small apartment in Brooklyn and ran it for two years before I moved everything to New Hampshire — into my new home in Peterborough. And I ran it, plus *Byte, Microcomputing, 80-Micro, Desktop Computing, InCider, Run*, and some other publications from there until I sold everything to IDG in 1983. Well, I did have to buy the house and barn next door for more magazine offices, a 24-room motel for software development, a house and barn in northern Peterborough for the book division, a house in West Peterborough for shipping, and so on. I gobbled up just about every available building. I probably shouldn't have let the growth get away from me like that.

The nice thing about a mail order business is that you can run it from anywhere, and you can start small. PC Connection started out in a farmhouse in Marlow (NH) and now they've taken over an entire shopping mall in Merrimack for their offices.

Look, you're never going to make much money working for someone else. The key to freedom is owning your own business. So find some innovative product and get started with an office at home like I did. In addition to running *73*, my products these days are books, which I write, print, and put together at home. Well, this is the information age, but the problem is that there is so much information that everyone is on overload. So I do my research and simplify the information, making it all available in one book.

Continued on page 59

Number 6 on your Feedback card

LETTERS

From the Ham Shack

James Alderman KF5WT. How can we revive, or save, amateur radio? Some hams have suggested that in order to maintain our viability we must work more at providing emergency communications. I have another theory.

As one who works in the radio communications industry, I can tell you that modern public safety radio systems are built with multiple levels of redundancy to avoid outages. For instance, in case power goes out, the systems my company builds will run on battery backup power for a few minutes until emergency generators come up. If the entire tower facility is destroyed, most radio systems have a whole separate backup tower site.

If dispatch consoles, or the phone lines that connect them to the tower site, happen to go down, dispatchers can simply use standard mobile radios to dispatch radio calls. In short, the chance of hams having to supply police and fire departments with emergency radio communications is getting less likely all the time since old style public safety repeaters are being replaced by 800 MHz trunked or digital radio systems.

However, hams can provide a valuable service to relief agencies such as the Red Cross and Salvation Army. These organizations provide direct relief in times of disaster and rarely have funds to spend on radios. If hams have emergency communications resources, such as multiple repeaters with wide coverage and backup power, well-trained operators who can quickly set up communications, the ability to operate both voice and packet in simple portable setups, and even portable repeaters to deploy in areas where relief operations are underway, we can provide a valuable service like no other radio service can.

But although hams can provide a service to the public in these times of disaster, there is one area where I believe we can provide an even greater service—and I further believe it's our only hope for ensuring the survival of our hobby.

We should focus on the educational benefits of amateur radio. Let me explain. In the two-way radio industry, it used to be that most new employees came up through the ham ranks. That is, kids who grew up tinkering with ham radio often went to work in the radio and electronics industry. This is no longer the case. So few young hams are coming up these days, our company (located in Dallas) often has to recruit out of state to even find radio installers. (Installing is a job that only requires minimal knowledge.) We can forget about finding a 21-year-old who knows anything about radio communications and can actually work on repeater sites. Ham radio is no longer a training ground for a high-tech work force. Of all my present coworkers, I would say only about one in 10 is a ham.

Ham radio can provide tremendous educational opportunities for young people. Here are a few possibilities that require minimal work on the part of clubs:

• Amateur radio day at local schools. Hams could set up two-meter stations in selected elementary or middle school classrooms (maybe five or six). Students in each class could prepare a short speech outlining what material has been studied over the past weeks, and select a spokesman to deliver the address over ham radio to all the other classrooms. Then other classrooms could ask questions. The benefit would be that all classes get the benefit of knowledge that was previously confined to only one classroom. Further, students would learn about speech writing, public speaking, passing information over two-way radio, and they might even pick up some interviewing skills.

• Amateur balloon launches. Hams could launch, and track with DF equipment, a helium balloon package to carry student experiments to the edge of space. The easiest payload is a 35 mm film camera rigged to snap photos every so many minutes. Or a crossband repeater, or "satellite," could be flown aloft to allow schools 100 miles apart to link up and share knowledge. A club sponsored project like this could provide an activity involving many areas of interest as well as opportunities for student involvement. There is a wealth of information about amateur balloon launches on the Internet.

• Amateur television. In many larger cities, amateurs transmit live coverage of shuttle missions on ATV. Since practically all schools already have cable-ready TV sets, a simple outside antenna is all that's required to pull in 440 MHz ATV pictures, provided the transmit site is within a reasonable distance of the school. This live coverage is available on the NASA Select Network which can be picked up on a standard C-band home satellite receiver. NASA makes many resources available to schools free of charge, including curriculum material for all grade levels that coincides with each shuttle mission.

These are only three of many ways that clubs, or just groups of amateurs, could have an impact on their communities. I've been working recently in my rural Texas hometown to try and implement some of these ideas, but I must tell you it has been a hard row to hoe. To start with, there is only a handful of active hams in the area any more, and there really aren't any young hams coming up through the ranks. From what I hear, this is the situation all over the country.

In order to get younger hams in our ranks, I believe we must be a fraternity that people would be excited to join. In fact, I believe that ham radio in general is in such a slump that the only way we can survive is to GIVE our way out of it. That is, we must begin to serve our communities and our local schools by providing a service that nobody else can. We must use our skills to educate kids, get them interested in science and technology, and provide an exciting and wholesome activity that the whole family can participate in. If we do this, our ranks will surely grow and amateur radio will have a bright future.

Gerald Wagman K2EWA, East Brunswick NJ. I enjoy reading "Never Say Die" though I am often in disagreement with what you say, sometimes vehemently, but I must admit much of it is thought-provoking in any event. And there some items I do agree with. I found the "We're At War," item in the July '98 column to be of particular interest, especially relating to the comments on studying the art of war. I spent many years in middle management in basic research in the pharmaceutical industry, and one of the best little books I've come across is titled *Leadership Secrets of Attila the Hun* by Wes Roberts, Ph.D. (Warner Books, 1985). This book can serve as a model in areas other than just management; it's a primer in leadership and Dr. Roberts has dissected Attila's role in life, generally thought of as that of a tyrant and a barbaric and ruthless pillager, by extracting the clever leadership principles that he used. It demonstrates that the techniques which Attila devised are readily applicable to our management leadership of today and I think that all of these young theoretically-oriented management

Continued on page 38

QRX . . .

QRUBZ?

When you live in rural Maine, shopping invariably means getting into your truck and driving anywhere from 50 to 250 miles on mostly deserted roads. There is very little to do. The radio provides only acid rock as an excuse for music, some screechy soprano on the PBS station or some hell-and-brimstone preacher who's determined to save me even if it means killing me. My two-meter rig was stolen on my last trip to the big city and even if I still had it, there are generally no repeaters or stations in range.

It was on just such a trip last week that my idle mind began to think about "Q" signs. The more I thought about them, the more silly they seemed. For example, QSL means, "Can you acknowledge receipt?" or "I am acknowledging receipt." What has that got to do with "SL"? It should be "QAR" and you should send a "QAR" card.

The more I thought about it, the more examples I kept coming up with. "QSY" means "change," either frequency or type of emission. What does "SY" have to do with change? It should be "QC," and if you want to be more specific, "QCF" for "change frequency" and "QCM" for "change mode."

"QRP" must mean "really poor," and can't afford a rig that puts out more than five watts. If it's "low power," call it that: "QLP."

"QRN" means "troubled by static," and "QRM" means "being interfered with." Therefore, "QTS" and "QTI" (troubled by an idiot).

"QRZ!" You are wearing something with a "rusty zipper" on it and should exercise extreme care when near RF. Basically, it means, "Who's calling?", so it should be "QWC."

"QTH." Well I guess you could say "the house." But what about all those people who live in apartments or condos? Too bad: You have no QTH, so no "QAR" card for you! Since it really means, "what is your position (location)?", or "my position (location) is," call it that, "QPL." I will send my QAR card direct to your QPL.

How about "QRL"? I am busy being chased by a roaring lion, or are you busy being chased by a roaring lion? It means I am busy/are you busy—do not interfere. So a simple "QB"—or for the purists who insist on three-letter signs, "QBZ."

"QSB." Now there is a good one. How about my "solder broke" and I am off the air. Or, not a mobile, stationary broadcast (there are several others, but propriety will not let me say them). It means signal strength is going up and down, ergo, "QUD."

Fortunately, for the reader, this was only a short drive (60 miles to the nearest Radio Shack) and it is time for me to return to reality (though there are those who would say that I have long since left that far behind). So 73, gb, gl, gldx, es cusn my QAR card is sure via buro.

TNX Dr. Hal Goodman W3UWH.

What to Do About Your Technician Accent

On FM, there is little need to repeat your callsign several times. "N3SZW listening," is sufficient. However, it may be necessary to repeat if the person you're trying to contact has his HT in scanner mode.

"Negative contact," and "clear" are also unnecessary if no one answers your call.

"N3SZW for ID" is superfluous. It's understood that you are identifying yourself.

Listen before you transmit. PTT (push to talk) on your microphone should be labeled RTL (release to listen).

Speak in plain, everyday language.

Q codes are meant for CW, not on repeaters.

When words must be spelled, they should be spelled phonetically. Cute nonstandard phonetics are questionable at best. However, "November Three Solid Zirconium Wire" might help someone remember your call.

Avoid endless signoffs. A simple "N3SZW clear," is sufficient to end your communication.

Excerpted by Bill Smith N3SZW, with permission from the ARRL, from *Your Technician Accent ....And What to Do About It!* by James Craswell WØVNE, *QST*, Vol. 82, No. 4, p. 88, and adapted here from *The Ham Arundel News*, Mar. 4, 1998.

Military to Help Save 70 cm

The ARRL has called out the United States Navy to help save the 70 cm band from being forced into a sharing agreement with land mobile users or possible reallocation to their exclusive use. Speaking at the Rochester Hamfest, ARRL First Vice President Steve Mendelsohn W2ML explained how it all came about.

"It occurred to me after talking to somebody at Dayton that we don't own the 440 spectrum. Most of you should be aware we are merely secondary users. And I wondered if the primary user was aware. So the League contacted the NTIA (National Telecommunications Information Agency), which is the government FCC, and in turn NTIA contacted the real user, the Navy. The Navy has just spent some 75 billion dollars—billion with a B, on a little thing called the Combat Engagement System. CES operates in that 400 meg band. So the Navy was real unhappy about the idea of sharing the band with anybody. And, of course, with the Navy, they have their idea of jammer hunting that is significantly different from ours. They have the hardware to enforce what they desire."

The fact that the Navy is siding with ham radio does not mean that the fight to save the 70 cm band is over. Congress wants more military spectrum turned over to the private sector for commercial use and the FCC is under pressure to accede to these demands. As such, ham radio operators cannot afford to become complacent. The battle is not over yet.

From *Amateur Radio Newsline*, via *The LCARA Patch*, July 1998, Tim Culek KQ8TC, editor.

Florida Ham Radio Hotline Has New Area Code

The amateur radio information telephone message system has a new area code. Pinellas County's (Florida) new area code is 727. Anyone interested in Clearwater, Largo, or St. Petersburg area ham radio clubs can call (727) 531-8135 for information. New hams, visiting amateur radio operators, and the public are invited to call the "Ham Hotline" as a quick way to get updates on local events, meetings, and testing sessions.

Located on Florida's west coast, on the west side of Tampa Bay, Pinellas County has about 3000 licensed hams. Pinellas County has an active APRS network, ground-breaking SkyWarn operations, 12 amateur radio clubs, and a growing ARES group. Any of these topics, or others, could be featured on the hotline's weekly message. These messages are not intended for radio rebroadcast.

TNX Amateur Radio Public Information Office, Pinellas County FL, news release, William Holcomb, editor.

The Code that Really Counts

The radio amateur is:

•Considerate — Never knowingly operates in such a way as to lessen the pleasure of others.

•Loyal — Offers loyalty, encouragement and support to other amateurs, local clubs, through which amateur radio in the United States is represented nationally and internationally.

•Progressive — With the knowledge abreast of science, a well-built and efficient station and operation above reproach.

•Friendly — Slow and patient operating when requested; friendly advice and counsel to the

beginner; kindly assistance, cooperation and consideration for the interests of others. These are the hallmarks of the amateur spirit.

•Balanced — Radio is an avocation, never interfering with the duties owed to family, job, school, or community.

•Patriotic — Station and skill always ready for service to country and community.

The original "Amateur's Code" was written by Paul M. Segal W9EEA, in 1928.

From the Spring 1998 newsletter of Voice of Idaho ARC, Steve Wade KF7YC, editor.

My Neighbor and Me

After being a Tech Plus for 19 years I decided that it was a good time to upgrade. I was nearing the time when I intended to retire, and I would really have time to pursue the hobby.

I ordered some code study tapes from *73 Magazine*. Every day I practiced receiving the code and before very long I was ready to take the 13 WPM test. I only needed to take the code test, and not the written test, because I was licensed prior to 1977.

I went down to the library in Delaware, just over the Pennsylvania line, where a group of local hams administered amateur examinations on the third Saturday of every month. Not only did I pass the 13 WPM test, but to my surprise I passed the 20 WPM test also. The VE recommended that I try the Advanced test. I did—and failed, but three months later I had my Extra class license, and set out to talk to the world.

I invested in an Alinco HF transceiver, a power supply, and a R7000 antenna. On the air, I was having a great time making contacts all over the world. There were times that I could have used more than the 10-watt output my transceiver provided ... so I decided to invest in an amplifier. I chose the Ameritron AL811, eagerly hooked up, and started to broadcast.

Things were going great until that day when my next-door neighbor came pounding on my door. I opened it to face a very upset man.

"Knock it off," yelled Mike. "I can't listen to my hi-fi! You're interfering with my music and I'm going to report you to the FCC!"

I tried to apologize but it was clear that Mike was not in any mood to listen. I decided to let some time go by and try to reason with him later.

The next day I knocked on his door and invited him to stop by and see my radio equipment. I apologized for the problems, but explained that I was entirely legal, and offered to work with him to eliminate the problem with his hi-fi. I demonstrated my radio and let him make a couple of contacts on 40 meters. He really took to it—in fact, he asked if I could help him get an amateur license!

We studied together for three months. Mike went down to the library, took the test, and is now the holder of a General class license—and is totally addicted to amateur radio. He spends every night chasing DX.

I just ordered cable TV. Since my neighbor got his license, I haven't been able to watch a clear TV picture!

TNX Jim Giunta WB3HDA.

Why Do You Get Upset When a Ham Erects a Radio Tower?

It doesn't
•Squeal its tires
•Screech its brakes
•Blow its horn
•Rev its motor
•Slam its doors at unGodly hours
•Shine its headlights in your bedroom window
•Backfire
•Bite you
•Bark or meow or howl
•Leave deposits on your property
•Dig up your garden
•Scratch on your door
•Widdle on your trees
•Scatter your garbage
•Drop leaves that you have to clean up
•Grow branches over your house
•Drop fruit or nuts which clog your rain gutters
•Block your view like a tree or building
•Grow roots that damage your walk, driveway, or drains
•Have rowdy parties
•Play loud music
•Or ride bikes across your lawn

From Marvin Wilson VE7BJ, originally in the *Ontario Amateur*. We adapted it in a rather cavalier way from the *Badger State Smoke Signals*, June 1998, Jim Romelfanger K9ZZ, acting editor. 73

Radio Bookshop

Phone 800-274-7373 or 603-924-0058, FAX 603-924-8613, or see order form on page 88 for ordering information.

Code Tapes

73T05 **Genesis 5 wpm code tape** This beginning tape takes you through the 26 letters, 10 numbers and necessary punctuation complete with practice every step of the way. $5.00

73T06 **The Stickler 6 wpm code tape** This is the practice tape for those who survived the 5 wpm tape and it is also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and spaced at 5 wpm $5.00

73T13 **Back Breaker 13 wpm code tape** Code groups again at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steely-eyed volunteer examiner who starts sending you plain language code at only 13 per. $5.00

73T20 **Courageous 20+ wpm code tape** Go for the Extra class license. $5.00

73T25 **Mind Boggler 25+ wpm code tape**. $5.00

The Ins and Outs of Surface-Mount

Everything you need to know to get started — or get better.

Homer L. Davidson
1517 1st Avenue North
Fort Dodge IA 50501-4237

Today surface-mounted devices (SMD) are found in many consumer electronics products such as TVs, VCRs, camcorders, and compact disc and cassette players. The surface-mounted part has opened up a whole new area of electronic construction. These tiny components are now available to the electronics hobbyist to miniaturize his or her favorite project (**Photo A**).

Now you can build SMD electronic circuits and projects like the big boys. In fact, they are a lot of fun to build. Of course, you must have a steady hand and a great deal of patience.

Because many surface-mounted devices have similar shapes and sizes, sometimes it is difficult to identify them on the chassis. The commercial resistors might appear as round, flat, leadless devices. The ceramic capacitor is a flat solid part with the terminal connections at the outside, tinned ends. The resistor might have several numbers for identification with lines at the ends, while the ceramic capacitor has a line at the top with a letter of the alphabet and numbers. Transistors and diodes are often identified with two letters. The SMD component terminals are found at each end, except on transistors and IC chips.

The commercial surface-mounted transistor might appear in a chip form with flat contacts at one side, top and bottom, or on both sides. You might find more than one transistor inside one chip. The same applies to fixed diodes and LED SMD parts. Two or more diodes might be found in one component. Remember, you can test these transistors and diodes like the big brother, or standard, components. The SMD part is mounted directly on the PC wiring.

Those tiny components

The SMD part available for electronic construction is marked and mounted somewhat like the commercial SMD component. These SMD components are miniature in size and must be handled with care. Since these parts are so tiny, they can easily be lost or flipped out of sight. For surface-mounted resistors and capacitors, select the physically largest, with the highest wattage and highest working voltage. Choose SMD electrolytic capacitors with at least a 16-volt rating for small nine-volt electronic projects. Select thick film chip resistors with a 1/8th watt size. Most ceramic chip SMD capacitors have a 50-volt working voltage. These surface-mounted parts are ideal for building the small electronic project (**Photo B**).

Identifying SMD parts

Within the latest TV chassis, surface-mounted parts are soldered directly to the board wiring, while standard components are mounted on top of the PC chassis. The electronics project PC board can be etched so that the SMD parts are mounted on top of the wiring. The most common SMD components available for electronic projects are capacitors, resistors, transistors, ICs, LEDs, diodes, and inductors.

The SMD parts found on the electronics chassis might look like tiny brown, black and gray specks. The fixed resistor might be marked with white numbers upon a black chip. A ceramic capacitor chip might have a letter with a number alongside to identify the value. Some bypass and coupling SMD chip capacitors are not marked at all. The

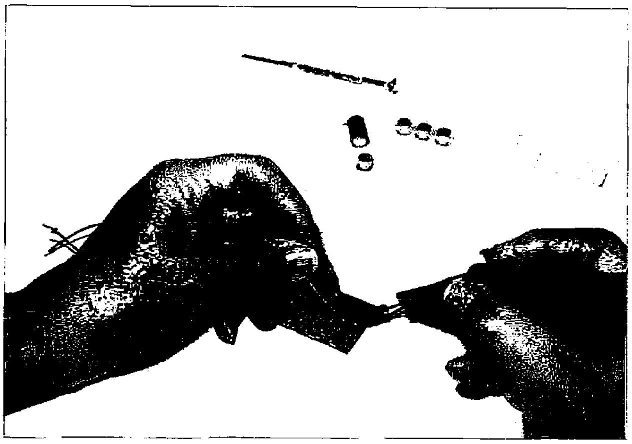


***Photo A.** Soldering the SMD component into the PC wiring with a battery iron.*

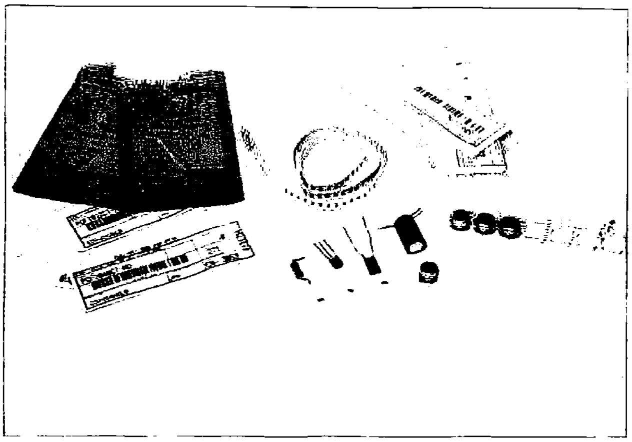


***Photo C.** Four tiny SMD chips are dwarfed by their common equivalents. From left: resistor, transistor, fixed cap, electrolytic.*

electrolytic capacitor chip can be identified with a white line at one end, indicating the positive terminal, while the aluminum electrolytic has a black line or area, which is the negative or ground terminal. Besides the polarity marking, the SMD chip electrolytic capacitor might have the capacity value and working voltage stamped on the top side.

The SMD transistor has three terminals, with two on one side and one on the other side. The terminals might be marked 1, 2, and 3. The ceramic IC chip has many terminals on each side, while some microprocessors have gullwing-type terminals. The SMD transistor or IC might have the part marked on top or no markings at all. Some transistors are marked with a number and letter on the top side. Of course, you must have a magnifying glass under a strong light to identify the small numbers and letters on the tiny SMD component.

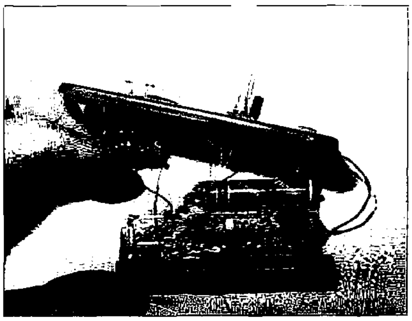


***Photo B.** A small AM radio made up of SMD components.*

SMD capacitor chips

The SMD ceramic capacitor chip might be available in three or four different case sizes: 1210, 1206, 0805, and 0603. I prefer working with the 1210 and 1206 case sizes, since they are physically the largest chips to work with. For instance, the SMD 1210 case is 3.05 mm in length, 2.54 mm in width, and 1.27 mm thick, while the 1206 is the same length (3.05 mm), 1.52 mm wide, and 1.27 mm thick. Naturally, the smaller the capacity in picofarads (pF), the smaller the case size of the capacitor (**Photo C**).

Most ceramic chip capacitors are available with a 50 volt working voltage. The capacity can range from 0.5 pF to 0.068 μF. These ceramic chip capacitors are available from some mail order firms in a single (1), 10, 100, 500, or 1000 lot price. It's best to purchase parts at a 10-lot price. The ceramic chip capacitor is used in bypass and coupling electronic circuits.

The surface-mounted chip and dipped mica capacitors are selected for RF, radio, microwave, and resonator circuits. The working voltage might be 100 and 500 volts from 1 to 1000 pF capacitance. These SMD mica capacitors are quite expensive compared to other SMD capacitors.

Remember, the ceramic chip capacitor is a nonpolarized capacitor. You can solder any end into the PC wiring circuit without any problems. The ceramic chip capacitor might have a letter and number stamped on the top indicating the actual capacitor value, while in other chips there are no markings and only end connections. Always keep those SMD parts inside marked plastic envelopes so they will not get lost or mixed up.

The SMD aluminum electrolytic capacitors are polarized and should have a 16, 25, 35, or 50 V working voltage. Do not use a 10 volt or less working voltage SMD electrolytic in a nine-volt battery circuit, as they have a tendency to break down.

Often the voltage and capacity are stamped on top of the electrolytic capacitor (**Fig. 1**).

The top black marked area indicates the ground terminal. Observe the correct polarity of electrolytic capacitors; if installed backwards, they can run warm, overheat, and blow up in your face. They are available from 0.15 to 1000 microfarads (μF). The SMD aluminum

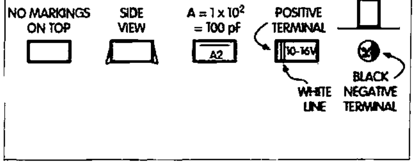


***Fig. 1.** The ceramic capacitor might have a letter and number on the top side to identify the chip and value.*

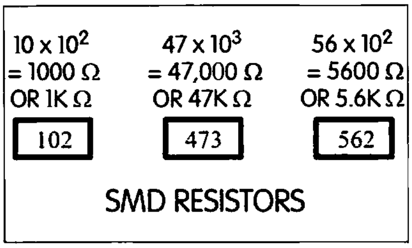


Fig. 2. The SMD chip resistor has several numbers on top to identify the value of resistance.

electrolytic stands up while the solid chip lies down on the PC wiring.

The tantalum electrolytic chip capacitors are found in a smaller capacity and can be purchased in 16, 20, 25, and 35 working voltages. The black polarity bar on the top side is the positive terminal. Most standard electrolytic capacitors have a black line that indicates a negative or ground terminal. These SMD electrolytic capacitors have the reverse, a positive (+) polarity with a black bar at one end. Place the SMD black line at the positive voltage connection.

The tantalum electrolytic are available from 0.47 to 47 microfarads (μF). The SMD aluminum electrolytic capacitor is used in B+, decoupling, and power supply circuits, while the lower-capacity tantalum capacitors might be found in coupling and bypass circuits.

SMD resistors

The SMD resistor can be identified by numbers stamped on the top side of the chip. These SMD resistors appear in thick film chips of 0805, 1206, 1210, and 2512 case styles. Choose the 0805, 1206, and 1210 case styles for electronic construction. The 0805 resistor is 1/10 watt; 1206 style is 1/8 watt; and 1210 is 1/4 watt. The 2512 case is a 1 watt SMD resistor. These SMD fixed resistors appear in 0 Ω, 10 Ω, and 1.0 megohms. The 0 Ω resistor might be used as a feedthrough or to tie two circuits together.

These SMD resistors can be purchased in 1, 10, or 100 lot prices. It's best to choose SMD resistors in a 10-lot pricing of each value. Remember, either end of a resistor can be soldered into the circuit with the resistance value at the top. For instance, the SMD resistor might have 102 stamped on top, where the first two numbers equal the amount and the last number indicates zeros to add. The numbers 1 and 0 thus would equal 10, and two zeros at the end would then mean a 1000 ohm or 1 k resistor or (**Fig. 2**).

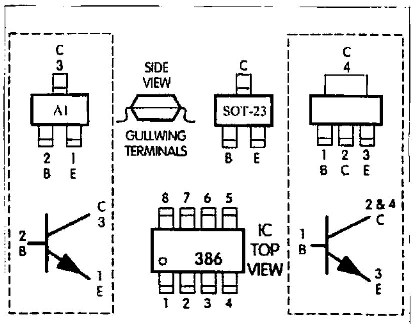


Fig. 3. The SOT-23 general purpose transistor might have a number and letter on the top side.

SMD transistors (SMT)

The surface-mounted transistor might appear as a chip with flat contacts at one side, top and bottom, or both sides. You might find more than one transistor inside one chip. The standard or conventional SMD transistor has an SOT-23 package outline, while the one watt power transistor has an SOT-89 outline with a heat sink. The SOT-89 and SOT-223 might consist of two transistors in one chip or in a Darlington arrangement.

The conventional transistor (SOT-23) is a general purpose transistor that you would find in electronic projects. Digi-Key uses part numbers such as FMMT3904CT-ND for the 2N3904 NPN transistor and FMMT3906CT-ND for the 2N3906 PNP type. The Mouser Electronics listings for the same type of transistors have part numbers of MMBT3904 and MMBT3906. The conventional 2N2222 general switching transistor in the SMT types is listed as MMST2222 at Mouser and FMMT2222ACT-ND (NPN) at Digi-Key Corporation.

The SOT-23 general purpose transistor has the collector terminal on one side (at the top), with the base to the left and emitter terminal to the right at the bottom side of package outline. Some have flat or gullwing-type terminals.

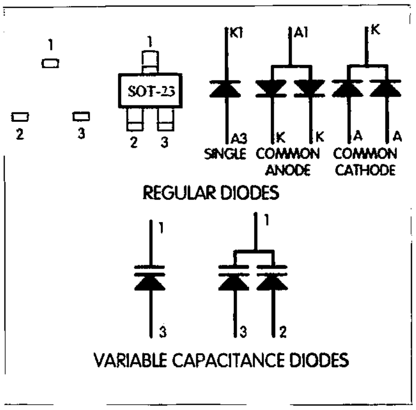


Fig. 4. The fixed diode terminals are listed as numbers and more than one diode may be found in one chip.

These transistors can be tested with the transistor tester or with the diode test of the digital-multimeter (DMM).

You can identify the SOT-23 general purpose FMM3906CT by a 2A stamped on top, and the FMMT3904CT by a 1A. The CMPT2222A switching transistor has a C1P on its top (body) (**Fig. 3**).

IC chips

The SMD IC chip is constructed somewhat like the standard IC with gullwing terminals. Usually these static-sensitive devices arrive in dark static-sensitive bags. Terminal 1 is identified by a U or indentation circle on top and is found at the bottom left hand corner, looking down upon the chip. For instance, the linear LM386 low power amp IC is an SMT p/n LM386-1-ND at Digi-Key and has an SO-8 outline. The 386 numbers are stamped on top with an indented circle at terminal 1.

IC chip devices are neither heatproof nor shockproof. They are made of ceramic or plastic molding, and they should not be subject to direct shock. Do not apply unnecessary stress to the chip. Handle SMD semiconductors with extreme care. Install the chip flat upon the printed circuit board.

SMD diodes

The leadless, fixed, Schottky barrier, zener, and variable capacitance diodes appear in SOT-23 packages. These diodes might look like three-legged

transistors. The SMD diode can be identified by two alphabet letters or numbers. You might find one or two fixed diodes in one chip (**Fig. 4**). Only two terminals are used with one fixed diode, while all three terminals are used with two diodes in one SOT-23 chip. These diodes can be purchased in one (1), 10, and 100 lot pricing.

There are several different packages the SMD diode may appear in. The SMD signal diode SD914 or MMBD914 might appear in an SOT-23 package, while an SMD SI signal diode appears in a round LL-34 chip. The SMD zener diode might be found in a flat round chip, or in an SOT-23 package. The case and power rating of a 3.6 V zener diode rated at 200 mW, 300 mW, and 400 mW are found in an SOT-23 package. The LL-34 case zener diode is rated at 500 mW in a round package. The SMD one-watt zener diode appears in a round (SM-1) or PSM flat chip. All SMD diodes can be tested with the diode test of the DMM.

Which side is up?

Mount the SMD resistor with the numbers on top and black side upward. The bypass or coupling chip capacitor, which might not have any markings on the body, should be mounted with the contact points downward on the end pads. Mount the small chip electrolytic capacitors with the capacity and voltage listed on top with contacts at the bottom. Make sure the white line on the top side of SMD capacitor connects to the positive voltage. The top black edge of the aluminum electrolytic capacitor is connected to ground.

The transistor is mounted with the number and letter (example: 1A) upward with the terminals over the three PC pads. Place the indented dot of the SMD IC at terminal one on the PC wiring. Make sure all terminals line up with the PC pads and connections.

Mounting SMD components

Fixed SMD capacitors and resistors are constructed so that solder is applied to each end, which then lies upon a solder pad of the PC wiring. If the resistor or capacitor lies over a piece of PC wiring, I like to place a thin piece

of cellophane tape over the wiring before the part is mounted. This method prevents any part from shorting between wiring and component.

First, I prefer to mount all fixed capacitors, then resistors, and then semiconductors last. Take one part out of the package at a time. Remove the part from the strip by sliding a razor or knife blade under the piece of cellophane, and then place the SMD part on a sheet of white paper. Seal the remaining parts on the cut tape strip with a piece of tape. Return all parts back to the original package or bag. Seal up with tape or staple the plastic packet so parts will not spill out.

Before installation, test each resistor for correct resistance and fixed capacitors for possible leakage. Measure for correct resistance and capacity leakage with the 2 k Ω range of your ohmmeter. Carefully place the meter test probes at each end of the component for a correct test. Likewise, check each SMD transistor or diode on the diode test of a digital multimeter (DMM), if one is available. Double check the polarity of diodes and electrolytic capacitors before and after installation.

Grasp the tiny component with a pair of small tweezers and hold the ends to be soldered over the correct set of pads. Make sure the wiring pads are tinned with solder. Choose the smallest diameter of rosin solder for those tiny connections. Tack one end in with the soldering iron. A dab of solder will do. Then go to the opposite end and apply enough solder to make a clean soldered joint. You are soldering the ends of the SMD part to the PC wiring pads. Go back and resolder the tacked-in side. A good soldered bond on the end of the SMD component will have a bright, clean connection.

Choose a 30-watt (or less) soldering iron with a fine point. A battery soldering iron is ideal and makes tiny bright connections. Do not leave the iron on the joint too long; it will damage the SMD part or lift the PC pad and wiring. Double-check the soldered connection with the magnifying glass. After installation, check for correct resistance across the fixed resistor and leakage across the capacitor.

The semiconductors are the most difficult SMD components to solder into the circuits. They have such tiny connections. Try to center the three transistor terminals over the right soldered pads or tabs with the small tweezers. Tack in one terminal to hold it into position. Then carefully solder up all three terminals with the fine point of the soldering iron. Be very careful not to apply too much heat from the iron and destroy the transistor.

Check for the indentation or dot on top of IC that indicates terminal 1. Make sure terminal 1 is at the right pad. Double-check to see if all IC terminals are over each PC wiring pad. Tack in one terminal on each side of the IC so it will stay in position. Now solder up all IC terminal connections to the PC wiring. Inspect each connection with the magnifying glass.

Test between each IC element or terminal with the 200-Ω range of the DMM for leakage. Sometimes too much solder will lap over and cause leakage between the two terminals. Make an in-circuit diode-transistor test of each diode and transistor. You want to make sure the transistor or IC is not damaged and has good clean soldered connections.

The resistance and diode tests of resistors, capacitors, transistors, and ICs ensure that no parts are damaged, the correct part is in the right position, and good soldered connections are made. This increases the likelihood that the electronics project will perform after all parts are mounted. When it's fired up for the first time, and it works, there are no greater rewards.

Testing components

Test each SMD component after it's mounted and soldered. Inspect each soldered connection with a magnifying glass. Check the resistance of each SMD resistor. Check each capacitor for leakage. Take a low-ohm continuity measurement across coils and inductors.

You will note that when a resistance measurement is made across the electrolytic capacitors, the meter hand will charge up or the DMM numbers will rise and fall as the capacitor discharges. Reverse the test probes and the capacitor will charge up again according to the amount of capacity of the electrolytic. The charge is very small on a 10 µF electrolytic capacitor when compared to a 100 µF one. The charge and discharge of the electrolytic indicates a good connection, normal capacitor, and no shorts or leakage.

Test each transistor with the diode-test of the DMM. Place the red probe (positive) of an NPN transistor at the base (B) terminal and black probe (negative) at the collector (C) terminal (**Fig. 5**). Note the normal diode-junction test resistance. Leave the red probe (+) at the base (B) terminal and place the black probe (-) at the emitter terminal. Notice that the two different

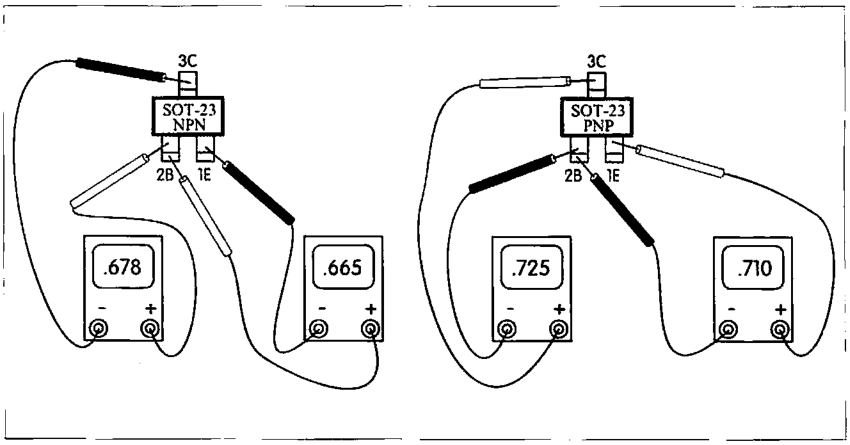


Fig. 5. Checking the normal transistor with a diode-test of the DMM. This diagram shows the forward bias test only. All junctions should show a very high resistance in the reverse bias configuration.

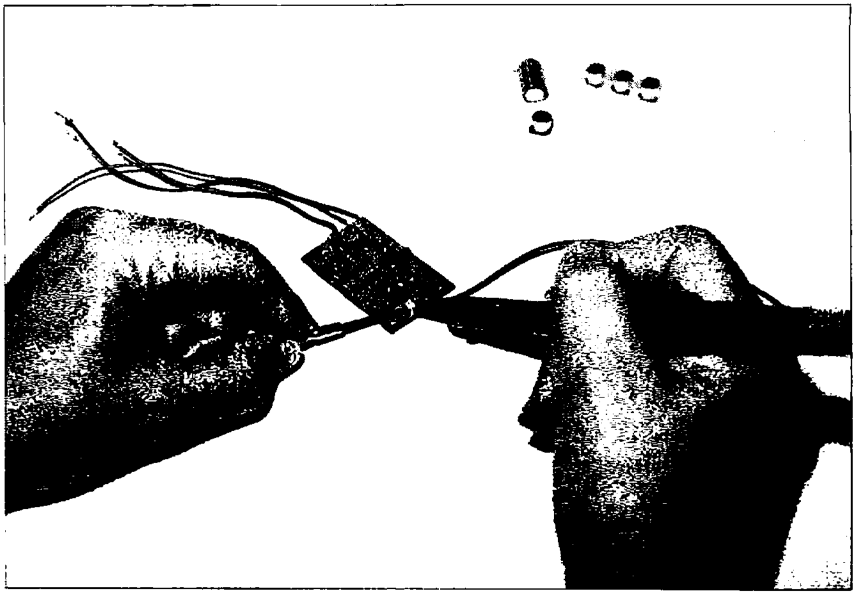


Photo D. Apply heat from the iron and pry up on chip to remove it from soldering pads.

resistance measurements are quite close with a normal transistor.

Now reverse the test leads. An infinite reading indicates a good or normal transistor. If a low resistance measurement is found below 100 Ω, in both directions, the transistor is leaky. The transistor is shorted between two elements if the reading is below 5 Ω. The leaky or shorted transistor will have a low ohm measurement with reverse test leads in both directions. Often, the defective transistor becomes leaky between collector and emitter terminals.

Removing SMD components

If you have placed the SMD part in the wrong spot or have damaged the tiny parts with too much heat, the component must be removed from the PCB. Remove fixed SMD capacitors and resistors by applying the iron first at one end and then quickly to the other. Pry up the SMD part with a small screwdriver. By quickly heating both ends, the small chip can be removed. Throw the removed part away. Do not try to reuse it.

Heat each individual terminal of the transistor and pry up each terminal with a pocket knife or small screwdriver (**Photo D**). Do the same with each gullwing terminal of the damaged IC until all terminals are removed. Touch up the soldering pads with solderwick and soldering iron. Lift the excess solder from the PC pads and wiring.

Where to locate SMD parts

Most SMD components for electronics projects can be ordered through electronics mail-order firms. You may have to shop around to acquire special SMD parts. Digi-Key and Mouser Electronics handle most SMD components, while other mail order firms might handle only capacitors and resistors. You can identify SMD parts with a typical case mounting, diamond markings, or SMD listings in the parts catalog.

73 Review

What is a Linear Amplifier Saver?

Why, it's the MFJ-214, of course!

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Linear amplifiers made for intermittent amateur HF SSB service aren't meant to be operated at full key-down power ... at least not for more than a very few seconds (and when the manufacturers say a few seconds, they usually mean it!). The power supplies used in amateur-grade amplifiers, the ratings on the tube(s) themselves, and the cooling systems employed are usually designed for voice-waveform, single-sideband, intermittent duty *only*, and any attempt by the operator to ignore these warnings is usually met with shortened component life or even immediate failure.

To make matters worse, in order to ensure correct tuning and best linearity, a linear amplifier should be tuned up at full PEP (peak envelope power)! Given these restrictions, how in the world can you properly tune up an amateur-grade HF linear amplifier ... if it can't be run at full output long enough to see when it is in tune?

The MFJ-214 Linear Amplifier Saver has been designed to solve this seeming paradox.

Here's what it does

The MFJ-214 is basically an audio square-wave pulse generator, coupled with a switching transistor driver. It's connected to your transceiver's CW key jack and it keys the transceiver on and off at a fairly rapid rate. This allows the linear amp to reach full output power many times each second, but for only a short period of time within the framework of any one of those on/off cycles in any second. This allows the amplifier to reach full *peak* power for a portion of each second, but keeps the *average* power at about half of that peak. That's a whole lot easier on your amp than flat-out, continuous, key-down tuning.

Here's how it does it

The square-wave generator in the MFJ-214 is a single NE555 dual-comparator IC, running as an oscillator instead of a comparator, followed by a 2N7000 FET which is used as a solid-state switch. The FET transistor switch keys the host transceiver's positive keying line via the transceiver's CW key jack (usually located on the rear apron of the host transceiver). The MFJ-214's circuitry will handle 50 volts open circuit and 100 mA of keying current. It can also be used with negative voltage keying lines if certain precautions are followed as outlined in MFJ's well-written accompanying manual.

Once connected to the host transceiver's CW key jack, and with the transceiver itself feeding into a dummy load, the '214 is ready to go.

First, a couple of definitions just in case you're not familiar with these terms. When you see the word "exciter" in quotation marks in the MFJ manual, it simply means the amateur "transceiver" that you're using, and the term "PA" means the final "power amplifier" stage in either your transceiver or linear amplifier. These are terms that were more commonly used in the past than in the single transceiver-oriented amateur radio world of today.

The nitty-gritty

The MFJ-214 has two (screwdriver-adjustable) internal controls: the pulse repetition rate control (which controls the frequency at which the NE555 is running), and the pulse duty cycle control (which controls how much of one cycle is occupied by each pulse, i.e., the pulse's width).

If you're not familiar with the concept of duty cycle, here's basically what it means: If you picture the time between two fixed points as the length of time of one cycle (at a given frequency), the duty cycle is how much of that time is actually occupied by the pulse maximum. **Fig. 1** shows the concept for three different pulse widths and their resultant duty cycles (usually expressed as a percentage), and **Fig. 2** shows how those pulses would key an

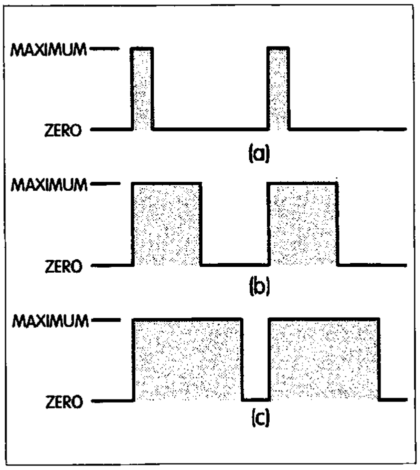


Fig. 1. Examples of two cycles of a square wave of the same frequency, each having different duty cycles. (a) 20% duty cycle: 20% of the time the output is at maximum, 80% of the time, it's off. (b) 50% duty cycle. (c) 80% duty cycle.

HF transceiver's CW keying line (and how they would appear on an RF monitor scope).

Simply put, duty cycle is the ratio of time on duty to time off duty, just as the name might imply. The MFJ-214's repetition rate (frequency) is adjustable from between 16 Hz and 41 Hz. The duty cycle can then be adjusted between about 30% on-time to about 70% on-time when the repetition rate is set at 25 Hz (or mid-range). Interestingly, the duty cycle range varies with the repetition rate, being greatest at the highest repetition rates. These conclusions are from measurements that I made on my own '214.

There are just two external switches on the MFJ-214: an alternate-action power on/off switch (labeled "Pulse Tune") that connects and disconnects the nine-volt battery power source, and a momentary "Carrier Tune" switch that allows the operator to momentarily switch to a steady CW carrier for comparison purposes as described later.

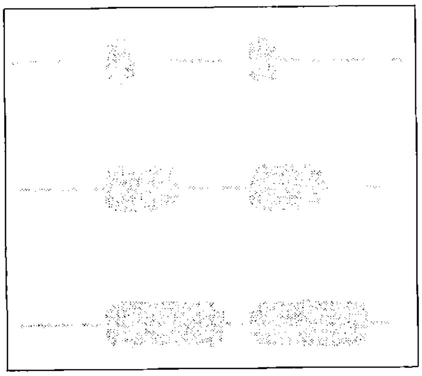


*Fig. 2. Same as **Fig. 1**, as duty cycles would appear on an RF monitor scope when keying an HF transceiver.*

The docs

The manual for the MFJ-214 is very clearly written (although maybe it's somewhat technical for newcomers at times) and describes typical "real world" speech duty cycle like this: "Unprocessed speech usually has an average power between 1% and 10% of peak envelope power. Sustained speech, such as a long 'hello,' produces average power levels that typically range from 10 to 30% of PEP. Heavy speech processing increases the average power, pushing the short-term average power of normal speech to 30% or more."

All of this makes more sense if you've ever looked at an amplifier's RF waveform on a monitor scope. Unprocessed human speech produces very "spiky" waveforms. As speech processing is added (or words are exaggerated), the waveforms look less and less spiky. This increases the average power in the speech waveforms, but as we've all heard, it also changes the overall quality of the sound.

Any processed speech must sound somewhat different from unprocessed speech because the two waveforms are different. The MFJ manual goes on to say: "Proper amplifier or transmitter tuning requires adjustments at maximum peak power, generally with maximum available drive from the exciter. A continuous tone or carrier is generally used during adjustment, and the amplifier is generally tuned for maximum output. The continuous single tone carrier ... will raise heat significantly. The MFJ-214 Linear Amplifier Saver allows proper tuning while driving the PA with a low duty cycle waveform." And so it does.

The manual also describes how to adjust both the pulse repetition rate and the duty cycle controls properly. It cautions that: "If the pulse rate is too fast and/or the duty cycle too long, the pulses will blur into one long steady signal." This, of course, would result in the operator being no better off than before, and the amplifier being tuned would quickly overheat. The manual goes into why the pulse duty cycle out of the MFJ-214 may not exactly match the duty cycle of the amplifier's RF envelope (it has to do with delays within the transceiver's CW wave shaping circuitry). It also cautions that if the duty cycle is too low, full peak envelope power may not be reached.

The manual further touches upon the problem of wattmeters, both averaging and peak-reading ... not all peak-reading meters are truly peak-reading! Your peak-reading wattmeter should read the same as an average reading

wattmeter when the MFJ-214 is in the Carrier Tune mode. When in the Pulse Tune mode, however, a true peak-reading meter may read a somewhat higher amplifier output wattage. This is due to both ALC foldback and power supply voltage sag during full-power output operation of your SSB linear.

MFJ suggests that the ideal position for the pulse rate and the duty cycle controls is achieved when an accurate peak meter reads maximum output, and then the controls are moved just a tad beyond that point (presumably to allow for some variation in battery voltage within the '214). Though the manual misses this point, all of this can be done with the linear amplifier in the standby mode, using only the transceiver's "barefoot" output power (generally 100 watts for most current HF transceivers). Once these controls have been set, then the linear amp can be placed in the "operating" mode and safely tuned with the reduced average power.

I found that with my station setup, the pulse repetition rate control runs at about mid-range, and the duty cycle control just a bit clockwise of mid-range. This gives me a reading of 50 watts on my averaging inline wattmeter, and 100 watts on my peak-reading wattmeter, with my HF transceiver operating "barefoot" into a 52-ohm dummy load ... just what I want. I can then switch my linear inline and take my time tuning it up, confident that the linear is pretty much "loafing along."

At the 25 Hz (or so) pulse repetition rate, my averaging meters show very little bounce. If you find that yours bounce too much at these settings, increase the pulse repetition rate and lower the duty cycle somewhat until your averaging meter shows about one-half of your transceiver's full CW power output. Then you should be all set.

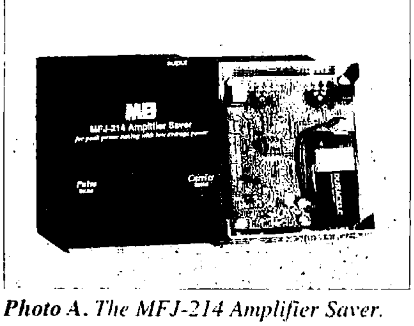


Photo A. The MFJ-214 Amplifier Saver.

Watch the words "average" and "peak." The whole idea behind using the MFJ-214 is to keep the average power low, while allowing the linear amplifier being tuned to reach full peak power ... but only for part of the cycle. That's also the whole idea behind balancing the pulse repetition rate and the duty cycle controls. What we want to do is to get the amplifier to go to its peak output for a long enough period so that we can read the meters, but also for a short enough period so that the amplifier is running at about half power as far as the adverse heating effects are concerned. That's the bottom line: keeping the average heating power to one-half or so, while pushing the amp to peak power part of the time.

The manual also stresses that a peak-reading wattmeter is not needed to adjust your linear amplifier correctly using the MFJ-214 Amplifier Saver. As they put it: "When the amplifier is tuned to produce maximum average power, when driven with a constant rate and duty cycle pulse, it is almost certainly tuned for maximum peak power." The manual also states that: "The least damaging and cleanest PA tuning condition generally occurs when the PA is peaked slightly beyond maximum output, in a direction that OPENS or UNMESHES the loading capacitor..."

It also warns about not having enough of the amplifier's "loading" capacitor in the circuit before applying full exciter power. Undercoupling an amplifier's tank circuit can cause the plate tank voltages to rise beyond the ratings of some of the components normally used in an amateur-grade PA tank circuit and thus can result in arc-over or other high-voltage induced problems.

That pretty much covers both the operation of the MFJ-214 Amplifier Saver accessory and the guidance on its use provided by the accompanying MFJ manual. When you factor in the current price of tubes and other components that can be stressed beyond their limits by using the old-fashioned, steady-state, "hurry-up-and-tune-it-fast" CW key-down method of linear amplifier tuning, the modest price for the MFJ-214 seems almost insignificant. Think of it as a kind of insurance policy against needless stresses on your linear amp.

The MFJ-214 sells for $49.95, and is neatly built on a double-sided glass-epoxy printed circuit board. It's contained inside a black aluminum box measuring three and a half inches wide by one and a half inches high by four inches deep, with just enough room to accommodate the circuitry and the internal nine-volt battery. It draws about 10 mA from the battery while in operation.

The only shortcoming that I found with the '214 was the lack of an on/off power indicator. It's a little too easy to leave the unit turned on, forgetting that the internal battery is wasting away unnecessarily. Sacrificing a couple of more mA by including a flashing LED power-on indicator would have been a good addition at the factory, but it's also one that can easily be added by the buyer should it prove to be needed at a later date.

How to get one

MFJ products are carried by most ham dealers nationwide, or you can contact MFJ Enterprises directly by calling (601) 323-0549 or (601) 323-5869. You can send a FAX to them at (601) 323-6551 or send an E-mail to: [techinfo@mfjenterprises.com]. MFJ also has a nicely done Web site at [http://www.mfjenterprises.com/] with downloadable information online as well as links to other amateur radio-related Web pages.

By the way, MFJ has a very customer-friendly manual policy (but please don't abuse it). You can request a free manual for any MFJ product before you buy it, so that you can see what's involved in its setup, operation, and maintenance before committing your dollars. Now *that's* a customer-friendly company, but you know, it probably saves them time, trouble, and money in the long run because of fewer returns from dissatisfied customers. It's smart business practice and others may be well advised to imitate it. 73

The Ideal Log?

This computer-style card file may be for you.

Robert Shrader W6BNB
11911 Barnett Valley Road
Sebastopol CA 95472
[w6bnb@aol.com]

One of life's little challenges: When contacting a station you are sure you have worked before, what was ... the operator's name? Station's QTH? Date last worked? QSL situation?

Do these questions ring a bell? Of course, if you keep no log there is not much that can be done about these questions except to delve back into your super-duper memory. The simplest solution for normal folks would be to keep a card-file log.

When first receiving General or Novice licenses, usually one of the first goals of amateurs is to talk to as many high-frequency DX stations as possible around the world. For many of us this mild form of madness in making only DX contacts wears thin. After a while it is found to be more satisfying to intersperse our DXing with talking about a variety of interesting amateur radio or other topics with amateurs on the air by phone, CW, and so forth—to "rag-chew" with them. Eventually, those 10- or 15-second DX contacts may even be given up entirely over the years.

The logging method described here is somewhat the same as logging with a computer, except that no computer is required. It is good not only for DXers, but also is really great for rag-chewers on all of our MF, HF, VHF, UHF, and SHF bands. When you learn to enjoy rag-chewing, you will find it helpful to keep a log of pertinent items of information about operators who have been worked before. Unfortunately, if you use a common logbook, it may take a lot of leafing back through many logsheets, or even logbooks, to find a "worked-before" station's callsign and to determine what previous notes can tell you about that other operator. If you have some items about the other person's activities readily available in your log, you can develop a much more enjoyable and worthwhile second, third, or even more frequent QSO.

Leafing back through a logbook for information about a previously worked station can waste a lot of time, especially if you haven't worked that station in several years. The best way to beat the leafing back is to use a card file, with one card for each station, no matter how many times it is worked. I have used a card-file log for more than 25 years. It is possible to put about 20 QSO entries for a station on one file card if both sides are used. When rag-chewing on any band, many stations will be worked several times and you get to really know the other operators.

A card file is interesting to use. Other operators with whom no contact has been made in some time may be astounded when they are addressed by name, are asked if they are still in the same QTH (which is named), are asked if they are using the same rig (which is also named), and are told how long it has been since the last QSO—in '85, '91, '97, or whenever!

Many amateurs have tried card-file logs, but given up after a while, because they went about it in the wrong way. I know I did. Then, after many years of using regular logbooks again, I felt there had to be a better way to keep track of stations worked. So I went back to file cards again, but this time I devised a better method—one that really works.

One difficulty with file-card logging is not being able to determine what stations were worked yesterday, or last week, or last month. There is no way to do this with file cards alone. However, there is a very simple fix for this. Use a little four-by-six-inch spiral-bound

notebook. Jot down the day's date on the first free line and after that, the callsign of each station as it is worked that day. With such a little notebook, a quick review of all stations worked recently is readily available. Full information about these stations will be on their file cards. Other uses for such a notebook might be to log the calls of stations checking onto regular nets, times/frequencies/results of tests made, and callsigns/time/bands/mode/etc., when contesting.

The secret of the successful use of a file-card system is the file cards used. It is possible to buy three-by-five-inch file cards, of course, but they are rather thick and are expensive. More important, because they are thick, not many will fit into any reasonably-sized filebox. What is the best alternative? Simple. With a paper cutter, cut two or three pieces of standard-size (eight and a half by 11 inches) 20- or 16-lb. typing or computer paper (cut down the middle, vertically) into strips 11 inches long by four and a quarter inches wide. Cut these strips horizontally into four "cards," each four and a quarter inches by two and three quarters inches. You can fit about 500 cards this thin into each two inches of storage box length. The 12-inch-long box suggested below will hold about 3000 cards and leave enough room between cards to allow adequate fingering space. If you have no paper cutter, a local printer can cut half a ream of paper to the correct dimensions. Make sure all cards are *exactly* the same height! The width dimension of file cards is not too critical, but the height of all cards must be the same or there will be trouble trying to finger through them when they are filed. It might be better to cut them to a two and one-eighths-inch height so they will be uniform in height. Variations in the 11-inch paper height seem to be more or less common when paper is purchased from different manufacturers.

A suitable file-card box is easily constructed. Glue and nail together an open-top box out of 3/16- or 1/4-inch plywood pieces. Cut them to produce a box with internal dimensions of four and three-eighths inches wide, ±12 inches long, and two and a half inches deep. If you work with metal, it should be simple to fold and solder or bolt together such a box. Probably even a heavy cardboard might be glued together. File your cards in this box by their station callsigns. It is handy to fashion a holder for the four-by-six-inch spiral-ring notebook and glue it to one side of the file box.

QTH	**OP'S NAME**	**CALL**
Address	Spouse's Name	Year Licensed
E-Mail Address		Work/Retired?
		Background, etc.
Rig/Power	Antenna	CW Speed

date/start time/end time/other RST/my RST/freq./mode/special info from QSO/hobbies/health/age, etc.
date/start time/end time/other RST/my RST/freq./follow-up on notes from last QSO, etc.
date/start time/end time/other RST/my RST/freq./follow-up, etc.

***Fig. 1.** One layout pattern that has proved successful for the author.*

If you are not experienced in keeping a card file of amateur stations, a recommended method is to file first by the station's district number and then alphabetically by the first, then second, and then third letters following the number. When there are number-letter duplicates, file these alphabetically by the letters preceding the number.

Let's check some examples. Here are some calls of stations that might have been worked:

W2NSD/1
W6ECU
K4NO
KL7RQ
W6BOB
K1AVG
K6ECU
N6ECU
K7NP
XE3MN
W4NO
WA6ECU
VE2ALU

These cards should be filed by their numbers first, then by letters that follow the numbers, and *then* by letters that precede the numbers. Any foreign station callsigns that start with numbers and then have letters can be filed separately, either before or after calls starting with letters. Can you put these in the correct order? (Answer at end.)

To separate the different district-number cards, use heavier but similar height and width separator cards. Glue small labels or tabs on them that project up above the separator card tops about one-quarter inch. (Standard three-by-five cards can be cut to this shape and work well.) On the tab, print with a black felt pen the 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0 district numbers for the callsign cards which will be filed behind them. The K1AVG card in our examples would be filed behind the separator card labeled "1." The VE2ALU card would be filed after the "2" separator card, and so on.

Since I live in the very large W6 district, I follow my sixth district separator card with 26 similar separator cards, except that these are alphabetically labeled with "A," "B," "C," etc. All of the many sixth district cards are filed alphabetically by the letters following the district number and behind the sixth district separator card. Since I am surrounded by several nearby seventh district states, I also use alphabetical separators with these cards.

If possible, it is best to fill out the file card for any CW, SSB, RTTY, etc., contacts while the other station is transmitting. For CW QSOs, this requires an ability to copy in your head. If copy is made on paper, the card can be made out at the end of the QSO. Don't wait until sometime later to do it, or you may get into trouble. As soon

as a CQ is heard, or when entering into a QSO, if you called the CQ, check the file to see if the other station has been worked before. It is OK to send "QRX min" to allow checking. If this is not done, you may waste time making out a second card for a station worked previously. At the end of the QSO, when all of the information wanted is entered on the file card, enter the station's callsign in the notebook, file the card, make out a QSL if this is desired, and you are ready for the next QSO.

You can enter information on the file cards using various schemes. One layout system that has been found successful goes like this: In the top left-hand corner, write the station's QTH; below that, the address if wanted; and below that, the E-mail address if wanted. Middle top, two lines: op's name, then spouse's name. Top right, four lines: callsign; year licensed; op's work, or retired?; and background/other info. See **Fig. 1**.

Next, three entries lined up straight across: station's rig/power at left; antenna info in middle; and CW speed to use at right.

Then we begin our QSO entries, starting at the far left and continuing across the card, using as many lines as necessary. Each entry looks like this: date/start time/end time/other RST/my RST/freq./mode/any special info from the QSO, e.g., hobbies, surgery, new car, age, etc.

The next entry would be the same, except that "special info" might include follow-up on the previous entry.

The difference between the start time and the end time can indicate what kind of a rag-chew it was. A 10-minute or less QSO indicates that there was not much of an interchange of interesting information. A QSO with a 20- to 60-minute difference says that a lot of information, probably quite interesting, was exchanged and that here is a good rag-chewer. Circling the "age" number, if one is given, may help to determine what subjects might be used during any upcoming QSO. The last-worked date is helpful. Working the same station too often may not be a good idea. For short DX contacts, a call, starting time, frequency, and

perhaps S-meter report in the notebook may be all that is needed, using no file card at all.

When a CQ is heard, check the files to see if that station has been worked before and to see if it seems desirable to do it again. Unrewarding QSOs can be red inked around the callsign so that you may not bother to answer that station's CQ again. For example, if a CW operator has a poor fist, won't slow down for you, uses inappropriate language, is unfriendly, or doesn't want to carry on a conversation, a red line around the callsign on the card might be warranted. Conversely, blue-ribbon QSOs might be indicated with a blue line around the callsign.

QSO times can be kept in UTC, although local 2400-hour time has its advantages. First, it requires no mental gymnastics to tell what part of the day the QSOs on a file card took place. Also, if a QSL is to be sent, it tells the other operator what time of day it was at your location when the path was good, without having to figure it out. When making out a QSL to a foreign station who only uses UTC, since you know the difference in hours between your local time and UTC, just add that number of hours to your local time to give the QSO time in UTC.

Over the years you might need to double the size of the filebox, or you may want to keep DX file cards in a separate box. Any second similar box can be glued or soldered to the side of the first one.

It is handy to be able to slide the file-card box under the rig to provide a clear operating position on the desk or tabletop. To do this, the transmitting/receiving equipment can be placed on top of an inverted-U-shaped one-inch-thick wooden shelf. It should be five or six inches high, at least two feet wide, and 16 inches deep. Make sure the upright support boards under the shelf are screwed together securely with a wooden backboard to give the shelving adequate lateral strength. The card-file box will slide under this shelf, making it readily accessible but out of the way. Your key or keys may be mounted in, or will slide into, this off-the-operating-position area, as will a hand-held microphone, preferably onto a small pad. Equipment controls may be more easily seen and operated if the equipment is mounted five inches or so above the tabletop. Small loudspeakers mounted in the back of this area will project received signal sounds directly at the operator, usually making earphones unnecessary.

After a decade or so of card filing, it may be wise each January to go through all nearby district cards and remove those showing no contacts in the last 10 years. The number of file cards should increase only slightly each year from then on if this weeding-out process is used. If more filing space is required, cards from slightly more remote states may be weeded out, or another box may be added. Nearby states' silent-key licenses can be checked each month to keep the file up to date.

When first starting a card file, the box will have mostly open spaces, of course. Go back through the last couple of log pages and make out some file cards to see how things work out. If you have half a ream of paper cut to card size (4000 cards), use some of these to fill the empty box space behind the filed cards. If you do your own blank-card cutting, find a friend with a table saw if you have none, and cut some two-and-a-half-by-four-inch pieces of one- or two-inch scrap lumber and use these as spacer blocks to fill the empty spaces in your box. As the box becomes filled with filed cards, remove the spacer blocks. Always keep a few blank cards just ahead of the first district separator card to provide easy access to blank cards.

To indicate something is special about certain cards, rub a red felt-tip pen across the right-hand top edge of the card. This provides easy identity when it is filed. If you have two or three categories of cards you want to identify, you can mark the top edges with different colored inks or mark different portions of the top edges of the cards.

Glue some "gliders" to the bottom of your card-file box so that the desktop will not be scratched as the box is pushed around the operating position.

Nothing fancy is required. Four round pieces of cardboard or felt, perhaps three quarters of an inch in diameter, will work nicely. Position the sliders about an inch in from each corner of the box bottom.

This logging method will enhance QSOs not only for you, but also for the other amateurs you contact. The most interesting QSOs usually occur when you ask questions about what the other person has done, is doing, or is expecting to do, or how their surgery went, or something else you picked up from the last QSO. Experience will tell what kind of questions to ask other amateurs to produce the most interesting responses and what to note on file cards. Asking questions always starts the other person talking, a good beginning for rag-chewing. A file-card log can also provide a fast check for DX stations, whether you want to work them again, whether they sent you a card or not, and so on.

As I mentioned before, a computer can be used to do essentially the same thing as a file-card system. I find it much simpler to use file cards than to boot up and get into a computer logging program, which also ties up my one and only computer. Any filing system is most handy when right in front of the operator. Computers are usually off to the side of the radio operating position. A file-card system can be a lot handier and more readily available. Rag-chewing and other QSOs will be made much more interesting if file-card logging is used.

Finally, a reminder that any filing system is only as good as its filer. Did you get your cards filed correctly? They should be:

K1AVG
VE2ALU
W2NSD/1
XE3MN
K4NO
W4NO
W6BOB
K6ECU
N6ECU
W6ECU
WA6ECU
K7NP
KL7RQ. 73

Intro to Superhets

Part 3: Accessories and conclusion.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

The addition of accessory circuits allows the superhet receiver to be used in many applications that might otherwise he avoided. An accessory circuit in any receiver is any circuit, other than the power supply, that makes the receiver more useful to the user and does not take part in receiving the signal. Circuits falling into that category are AVC, AGC, AFC, noise limiter, S-meter, tuning meter, squelch, and BFO. Each circuit contributes to the comfort and convenience of the user.

AVC-AGC

AVC and AGC circuits are essentially the same and are used for the same purpose, that is, to reduce the gain of controlled stages based upon the level of an incoming signal. AVC stands for Automatic Volume Control: it was used to control receiver gain in AM radios as shown in **Fig. 1**. The objective was to provide a means for adjusting the signal level at the detector in order to provide a fairly constant audio level recovery as various stations were tuned and when the signal amplitude of a selected station varied due to propagation changes. The AVC voltage was developed at the AM detector as the rectified output from the received signal which made the voltage proportional to the amplitude of the received signal.

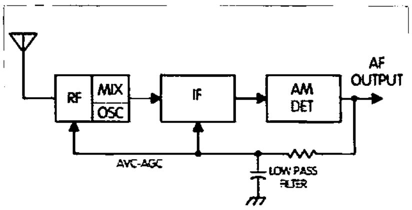


Fig. 1. AVC-AGC voltage derived from the detector and used to control the gain of the RF and IF stages.

When television came into being, a concern for controlling the picture contrast developed. AVC was then used in TV sets for controlling the contrast, but now audio "volume" was not of concern so the name was changed to AGC for Automatic Gain Control. The AGC function is now used in many applications beyond those required in receivers.

Because the AVC-AGC voltage is developed at the detector, it contains all of the modulation products as well as represents the received signal amplitude. All of the modulation products must be removed before the voltage can be used for gain control, and an RC filter having a long time constant is utilized.

AFC

AFC is Automatic Frequency Control, used to counteract the oscillator drift in tunable receivers. One of many available AFC circuits is shown in **Fig. 2**. AFC in an FM receiver is essentially in the same form as the steering voltage function used in a PLL circuit. When an AFC circuit is connected to a tunable oscillator, the frequency of the oscillator can be varied by changing the tuning voltage applied to it. The receiver's oscillator can be kept tuned to a given station or signal by applying a DC voltage to the AFC circuit that was derived from the FM detector. The polarity of the derived voltage determines in which direction the oscillator is to be moved, and the amplitude determines how far.

S-meter

An S-meter used in older receivers was an analog function utilizing a milliammeter which was connected into

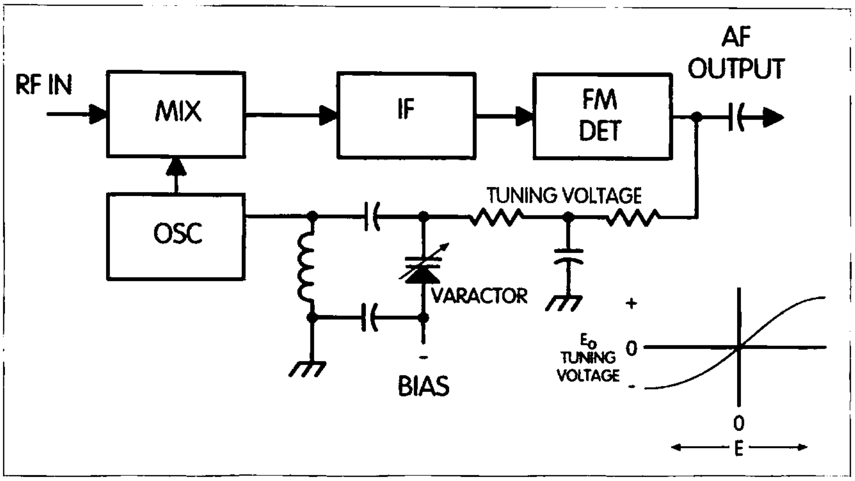


Fig. 2. An AFC circuit implemented with a varactor. Tuning voltage is derived from the FM detector.

the receiver's circuit to measure the relative signal strength of an incoming signal. The meter provided a visual indication of signal strength. Modern receivers use an LCD/LED bar for the same purpose. At one time, electron-ray tubes, sometimes called cat's-eye tubes, were used. They provided a soft green glow in a somewhat round configuration where a dark pie-shaped wedge existed on one side. The wedge would get narrower as the signal strength increased, and provided the user with an indication of tuning. The wedge provided little in the way of a relative signal strength between stations unless the strength differences were significant.

Signal strength indications are relative and not absolute because of the many involved variables that affect the meter indication. In the past, S-meters had a scale calibrated in S-units from 0 to 9 and decibel graduations above 9. Each S-unit was equal to 6 dB of signal voltage change at the antenna terminals, providing a signal strength indication (0 to 9) from 0–54 dB. Signal strength above S9 was indicated directly in decibels.

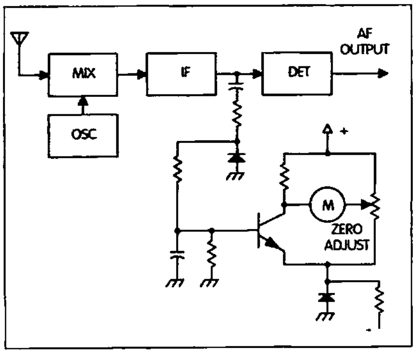


Fig. 3. S-meter circuit. The signal output from the IF is sampled, rectified and filtered. The rectified voltage amplitude is essentially proportional to signal amplitude.

The circuit for an S-meter is similar to that of a basic voltmeter having an amplifier driver, and receives its signal voltage level from any circuit in the receiver that provides a relatively proportional response to the amplitude of an incoming signal. **Fig. 3** shows one of the many techniques for implementing an S-meter, in which the incoming signal is sampled and rectified, with the resulting DC voltage applied to a meter within a bridge circuit. The transistor is biased to obtain a "zero" indication on the meter in the absence of an incoming signal. The rectified voltage, which is essentially proportional to the strength of the incoming signal, will drive the meter up scale, providing the user with an indication of relative signal strength.

Tuning meter

A tuning meter follows the same circuit design concept as the S-meter, except that the meter is a center-zero device. For the tuning meter to function, the detector must be capable of producing a DC output voltage relative to the incoming signal's position within the receiver's passband. A circuit

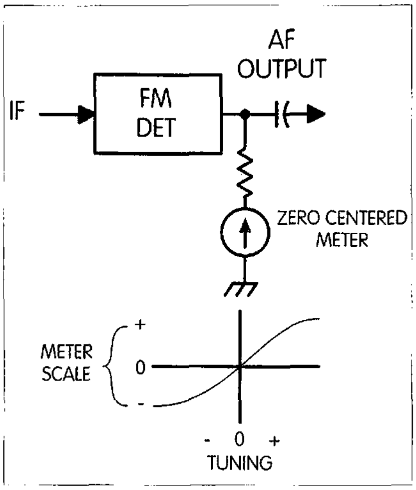


Fig. 4. A tuning meter used with an FM detector capable of producing a DC voltage that is relative in amplitude to the position of a received signal within a receiver's passband.

configuration for a tuning meter is shown in **Fig. 4**. The meter obtains its control voltage from an FM detector, where the voltage amplitude and polarity follow the position of the received signal relative to the center of the receiver's passband. As long as the received signal is in the center of the passband, the meter will indicate zero, but as the signal moves to either side, the meter will indicate the change by moving to one side or the other as well.

Having an FM signal centered in the receiver's passband is important from the standpoint that the quality of the recovered audio will degrade when the signal approaches the edges of the passband. A tuning meter provides an indication of when the receiver is properly tuned. Because of oscillator drift in some FM receivers, AFC has been used to keep the receiver tuned to the selected station. In this case, the tuning meter would just verify that the receiver remains tuned.

Squelch

Constant noise from a receiver becomes bothersome for people having to listen for many hours per day. This noise is the random noise that the receiver detects during the time stations are off the air. A squelch circuit will quiet the receiver's audio circuit during a no-signal period by applying a control voltage to a gated audio amplifier.

Many methods have been devised to squelch a receiver. They have ranged from mechanical to electronic, with an electronic version shown in **Fig. 5**. Early squelch circuits used a relay to short out the audio amplifier input terminals when a signal was not present. Relays had a slow response, in addition to a reaction differential (hysteresis) which caused them to remain closed should the received signal amplitude be marginally low, or open if not set tight enough.

Various electronic circuits have been developed that get around the problem. In essence, there are two forms of squelch control circuitry. The first follows the pattern of the relay which operates as a function of received signal strength (signal strength operated); the other is a noise-operated system. FM receivers amplify and rectify the noise output from the detector (at approximately 20 kHz) which occurs in the absence of an incoming signal. The noise level decreases as the strength of the received signal rises. Using the noise detection approach makes the squelch action faster and more reliable. Once detected, the noise-derived voltage is used to control the passage of audio from the detector to the audio amplifier through a gated audio path. In **Fig. 5**, an FET is used to clamp the audio channel, significantly reducing the audio voltage level presented to the audio amplifier.

Squelch circuits in modern receivers are implemented within the IF/detector IC in most cases. However, it's possible to implement a squelch function using discrete parts should it become desirable to add the function to an "already designed" receiver.

Noise limiters

Noise in receivers is always a problem. Since noise is characteristically an amplitude voltage function, it affects AM receivers the most. The purpose of the noise limiter is to discriminate between sounds made by noise sources and those received from a transmitter. This is a difficult task for a noise limiter because noise is typically generated as pulse noise or continuous noise.

Pulse noise comes in spurts like the pulses made by an automobile ignition system. Continuous noise is like that made by electric motors, shavers, alternators, and so forth. Because of the structure of continuous noise, it is extremely difficult to eliminate once it gets into the receiver. Pulse noise, on the other hand, is easier to remove because pulses are widely spaced, allowing a limiter circuit time to react and reduce the effects of the noise pulse.

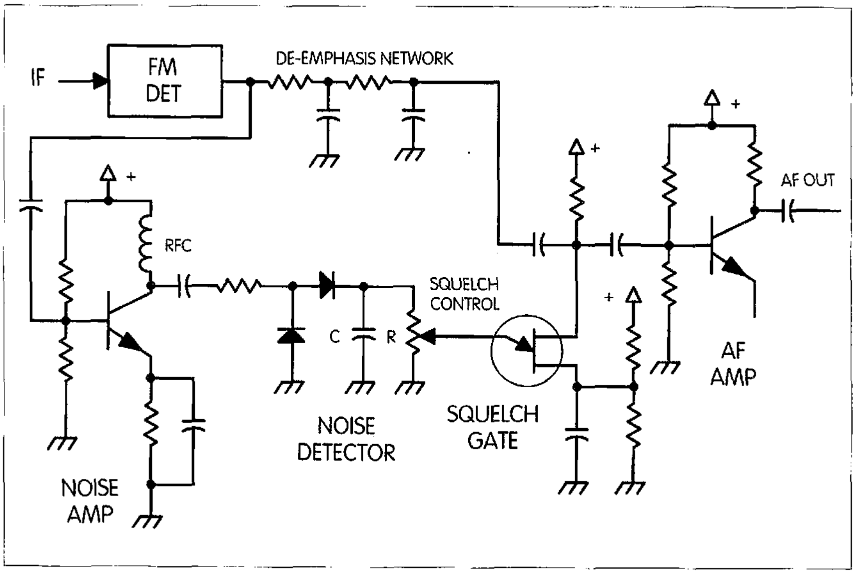


Fig. 5. Example of a noise-operated squelch gate. The function is based on the presence of white noise in the signal channel during the absence of an incoming signal. Values of C and R establish a time constant for opening and closing the squelch gate.

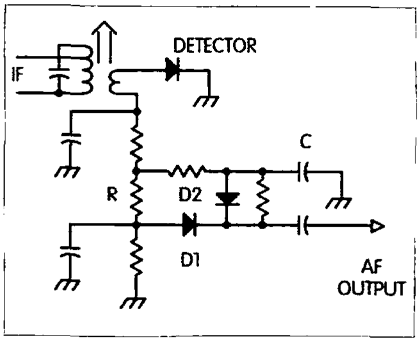


Fig. 6. Series-shunt diode noise limiter used with an AM detector. Capacitor C establishes a long time constant to hold the switch threshold during a noise pulse.

Perhaps the simplest and most effective noise limiter is a series-shunt limiter as shown in **Fig. 6**. Signal and noise voltages are developed across the resistor network and would normally be transferred to the audio stage. However, very little of the noise pulse is allowed to pass through the circuit onto the audio stage as the noise pulse itself is used as the trigger to close the noise gate.

The voltage across resistor R will increase during a noise pulse, causing diodes D1 and D2 to react. The noise pulse has a steep wavefront and a high amplitude that drives the shunt diode D2 into conduction during the duration of the pulse. During conduction, D2 shorts the audio path to ground through the low reactance of capacitor C.

Simultaneously, diode D1 will be reverse biased, essentially disconnecting the audio path between the detector and the audio amplifier. Some of the noise pulse will pass through because the diodes are not perfect switches, but the offending high amplitude portion of the pulse is removed. The circuit is self-adjusting in terms of signal amplitude, such that an incoming signal at any fairly constant amplitude will charge capacitor C to a threshold voltage value and the signal amplitude at that level will not be treated as noise, unless it also exhibits a steep wavefront. Noise limiters are quite effective for the communication of voice with minimal distortion, but the rapid level changes contained in music will cause a noise limiter to clip and distort the audio

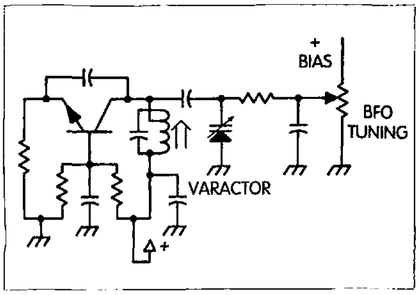


Fig. 7. A variable frequency BFO implemented with a Colpitts oscillator. A varactor is utilized for frequency control.

BFO

When a continuous wave (CW) signal or a single sideband (SSB) signal is to be received, it is necessary for the receiver to beat (mix) a local signal against the incoming signal. The beat note created when listening to a CW signal must be audible; otherwise, the operator hears only noise popping in the receiver. The typical beat note produced is usually between 400 and 1200 Hz and is selected for ease of copying. A BFO can be implemented by using either a fixed or variable frequency oscillator. A variable one is shown in **Fig. 7**.

For SSB operation, the BFO is used for carrier reinsertion where the oscillator is heterodyned against the incoming signal to become the carrier that was removed at the transmitter. To provide proper recovery of audio, the BFO's frequency must be in the same relationship position to the sideband as was the original carrier. If the BFO was operating at any other frequency, the audio would tend to sound unnatural.

Final notes

The superheterodyne receiver concept was developed in 1932 and has existed with little change over these many years. The development of integrated circuits has made the assembly and design of a receiver much simpler, with results far exceeding those of the original design. With the evolution of receivers, the number of conversion steps and the narrowing of the signal passband have brought forth some very interesting designs.

Perhaps one of the simpler design versions is the direct conversion superheterodyne, which converts directly from RF to audio. It embodies the principles of the superheterodyne without the complications of the IF amplifier. In other words, the detector is preceded by a mixer-oscillator providing a direct frequency conversion from a selected radio frequency to an audio signal. Because of the close frequency proximity between the RF and oscillator, the trick is to prevent the local oscillator from masking the incoming signal.

G'Day, OM!

On the road with the first-ever all-ham RV tour of Australia and New Zealand.

Jack McKenzie N5MFG
Rt. 3 Box 177-B
Cleveland OK 74020-9519
[n5mfg@juno.com]

Recently, 20 hams and their XYLs (most of whom are also hams) completed a tour of the eastern coast of Australia, from Sydney to Brisbane, and both the North and South Islands of New Zealand. The reception that we received from local hams in both countries was overwhelming. Our arrival and our itinerary were both broadcast far and wide over amateur radio, and resulted in local hams greeting us at almost every stop.

The tour was organized by Dick W4AOP and Meredith Glover W4AMK, who visited both countries two years ago as the only hams among 20 other couples. They enjoyed meeting local hams so much at that time that they thought it would be great to put together another tour made up of *all* hams.

Australia

We arrived in Sydney at the unholy hour of 6:00 a.m. and were greeted by officials of the Wireless Institute of Australia (New South Wales Division): Eric Fossey VK2EFY, director, and Geoff McGrorey-Clark VK2EO, division president. They then presented each of us with an elegant scroll conveying honorary membership in their organization. Later, after we had picked up the little camper vans that were to be our constant companions for the next month, Eric led a group of us through the maze of roads that is downtown Sydney to the offices of the Australian Communications Authority, where we became instant VK2s.

Actually, we learned to drive on what they call the "correct" side of the road without too much difficulty. I made a sign for my back window which read "STUDENT DRIVER from the USA" and everyone was very nice, deferring to me because they realized I didn't know what I was doing!

While in Sydney, we enjoyed the tourist bit in visiting their unbelievably beautiful and stately Opera House, and enjoying a harbor cruise that included lunch aboard a replica of the *HMS Bounty*. But the real reason that we came was to visit with Down Under hams.

The next day, while on the way to our next destination of Port Macquarie, we accepted an invitation from Eric to visit and participate in the New South Wales Division's weekly 10:00 a.m. Sunday broadcast from VK2WI, their extensive station located in Dural. There, high on a hill in a brick building, was the VK2WI station complex, composed of more than a dozen individual stations that broadcast on 13 different bands simultaneously! Although approaching its 40th anniversary at this location—and with somewhat dated tube-type equipment, at that—it is an effective and impressive station, complete with soundproof announcing and engineering booths. Of course, we were a topic of that week's broadcast, which was followed by "Call Backs," in which hams from all over Australia (and the world) can call in on any band from 160 meters to 2.3 cm and have a QSO with VK2WI. That day, one of our group, Harry WB2SFZ, took over an announcer's booth and QSO'd with a number of VK2s.

At Port Macquarie we visited the Kingfisher Wildlife Park, and then it was on to Wauchope and the lovely rural home of David VK2AYD and XYL Dee Pilley, where we were met by 32 members of the Oxley Region Amateur Radio Club. They proceeded to put on a real Aussie barbecue—steaks, chicken, sausages, you name it. David and Dee and our leaders, Dick and

Meredith, have been long-time friends, having met when Dick pulled David out of a snowdrift in Bucks County, Pennsylvania, many years ago.

David was responsible for getting the word out about us all over the South Pacific and alerting the clubs and associations in both Australia and New Zealand of our plans. He also cooked us 72 porterhouse steaks! We were overwhelmed by the friendliness of all the local hams and the welcome that we received.

Anyone want to send E-mail? Well, yes. Bill Stofmeel VK2WST sent one for me to my family and ham friends back in the States. After I got home, I discovered that Bill had added to my message, "Hello from Bill and Tony. We just got back from the barbecue and they all had a great time—Cheers to you all ... VK2WST." This handling of E-mail for us continued at nearly every stop. After visits to Woombah and Brisbane, it was finally time to turn in our RVs and fly to New Zealand.

South Island, New Zealand

We arrived in Christchurch, picked up new little camper vans, and settled in for the night at a van park. Our arrival was announced on their National System along with our itinerary, and plans were made throughout both islands to greet and meet us. Their National System is a series of 13 dedicated, linked high-quality repeaters on the 70 cm band. When a station accesses one of these repeaters, the signal is relayed to all other repeaters in the system and can be heard simultaneously up and down the country. For example, a station in Wellington can talk via the system to a station in Auckland as if he or she were in the local region.

In New Zealand, our US licenses were good for 30 days of operation on VHF. We merely added /NZ to our callsign. No fees and no paperwork! Leaving Christchurch, we headed for Lake Tekapo, Dunedin, Te Anau, Queenstown, the West Coast, and Picton. At Lake Tekapo, about half our group took an hour-long flight over and around Mount Cook (12,306 feet) and the Southern Alps. Personally, I got a lot closer to Mount Cook than I ever wanted to!

Photo A. Would you let this group into your *country? (Photos by author.)*

At every stop, the local hams would come out to meet us. In Dunedin, a couple dozen came, including Stan ZL4MB and XYL Sadie (who sent E-mail for many of us and also brought us copies of *The Christchurch Press*, which contained an article about our caravan and a large picture). Don ZL4TGR brought grapes for all of us, which we thoroughly enjoyed. We visited a rookery of yellow-eyed penguins and the only mainland nesting colony of royal albatrosses in the world (these birds have a wingspan of 15 feet!).

We drove south, surrounded by snow-covered mountains, iridescent lakes, and rolling fields of thousands upon thousands of grazing sheep. We will also remember this area as the land of the one-way bridges, including two, believe it or not, that we shared with a train! The highway would suddenly curve over to the train track and we would straddle the rails with our little camper vans. Across the train trestle we would go. That evening one of the local hams told us, "Not to worry, mate, there's only two trains a day on that line!"

On the west coast of South Island, among the glaciers and fjords, we enjoyed a spectacular cruise on Milford Sound, a fjord said to be the deepest in the world. Considering that it is one of the wettest places on Earth, we were blessed to have clear, sunny weather.

As we departed the town of Fox Glacier, heading toward Greymouth, a distance of some 122 miles, we commenced hearing Bob ZL3ADH calling

Photo B. Reportedly there were no shrimp on the barbie at the lovely home of David VK2AYD and Dee Pilley in Australia, but plenty of other goodies kept everyone happy.

***Photo C.** Guess what you run into—or stop for—on New Zealand's South Island?*

us on 146.55 simplex, our caravan traveling frequency. He said he was in Greymouth. One of our bunch, Dave KI5OJ, worked him with an ICOM IC-W32A half-watt HT into a home-brew J-pole lashed to his rearview mirror with duct tape! Dick W4AOP talked with him using a mag-mount antenna stuck to the top of the kitchen stove inside his camper van. Some of our group had stayed to tour the glaciers by helicopter, so Bill WB8AMD worked him with his HT "helicopter mobile."

That night we had a big bonfire on the beach. All the local hams, including Bob Boote ZL3ADH and his XYL Val, were there, and Bob explained that he had used a Kenwood TS-711A into a linear amplifier which fed 80 watts into a 16-element collinear antenna array. But we were still amazed at two-meter simplex at that distance.

North Island, New Zealand

We loaded our little vans on a ferry for the three-and-a-half hour crossing to Wellington and the beginning of our tour of North Island. Hams on South Island had told us that they had one-fourth the population and three-fourths of the beauty of the country. But I'm not so sure: North Island is certainly scenic—and the hams are just as friendly!

Traveling north, we came to the seaside village of Te Awanga, which is near Napier and Hastings. We learned that their amateur radio clubs are set up as branches of the New Zealand Amateur Radio Transmitters, which is the same as our own ARRL. While in the area, we were visited by hams from the Napier Branch, including Les Reid ZL2LR, section leader of the Amateur Radio Emergency Corps, and XYL Betty. The Hastings Havelock North Branch was represented by Branch Chairman Dave ZL3DK and XYL Irene. They arranged a delightful dinner for us attended by 20 or more local hams, all of whom brought QSL cards to exchange with us. And while there, we visited the Art Deco city of Napier as well as took a chartered bus to view the gannet seabird colony at Cape Kidnappers. This included a wild ride over perilous back sheep country in getting there. We also enjoyed joining in on their morning "Cornflake Net" on 146.700.

We continued on to Rotorua in the north central part of North Island and through an area of intense geothermal activity. Many of us visited the Ohaaki geothermal power station and walked through an area of bubbling mud and volcanic craters. Our van park had huge hot tubs, fed from thermal springs, that we weary travelers enjoyed shortly after we arrived. While we looked at craters others fished, Lake Taupo being right on our route. Cecil N5UUR and Paul WB8TTQ, together with XYLs Trudy and Martha, caught five huge trout that they cooked and which fed most of our group. That evening, Ted Bretherton ZL1MG, president of the Rotorua Amateur Radio Club Branch #33 and XYL Margaret ZL1TYA, along with at least a dozen other members, came to our park and brought food and drink. The welcome that we enjoyed at every stop was just fantastic, and Rotorua was certainly no exception.

The weather was superb for traveling. Murray ZL1BPU told us, "New Zealand is a rainy place, but recently it has been sunny and warm with less than the usual rain. There is no sign of approaching winter except for the first appearance of fall colors on trees and a distinct coolness in the air. In our part of New Zealand, there is no snow and very rarely a frost."

We wrapped up our tour of North Island with a full-day bus trip to the northernmost point of the country, called Cape Reinga. Here is where two oceans meet, the Tasman Sea and the Pacific Ocean, and you can see very clearly the actual line of demarcation between the two. To get there, our bus actually drove for 45 miles in the surf along what they call "90-Mile Beach," happily hydroplaning this way and that, throwing out a twin roostertail behind!

All things must come to an end, and so did our caravan Down Under. We toured Auckland, and then had a final banquet attended by hams from several clubs in the Auckland area. This included Peter Smith ZL1ARB, president of North Shore Branch #29; Irving ZL1MO, secretary of Rodney Branch #71; and John Bell ZL1FB, chairman of Hibiscus Coast Branch #80—along with many members from each of their branches.

We hope that our little caravan helped promote amateur radio in both Australia and New Zealand. I know that we created a lot of publicity. Articles

Continued on page 56

***Photo D.** One good flock leads to another—this time, of ham RVs waiting in NZ for the ferry to cross from South Island to North Island.*

Just the TiCK Kit

Embedded Research's memory keyer is now available with beacon mode.

Breckinridge S. Smith K4CHE
104 Brookfield Drive
Dover DE 19901

I sit there at the kitchen table, keying the paddles and getting responses from the tiny board lying in front of me. As my wife eyes the scene, you can sense that she is not too pleased with the shrill dits and dahs from the piezo element that are bouncing off the walls of the kitchen.

I admit the setup was a little strange; I had the TiCK with its wires going to a nine-volt battery, and three wires going to my home-brew paddles. The little keyer board was just floating around the table supported by its wires.

Finally, she asks, "What is that?"

I respond, "It's a TiCK."

"Have you been in the woods?"

"No."

"Then why the tick thing?"

"It's a keyer—TiCK stands for Tiny CMOS Keyer. I'm testing it for an article."

"Why do you have to test everything?"

"I like to test things to see how they work. Right now I'm trying to figure out how to play back my message."

She says, "Why don't you read the manual? I bet you haven't read it ..."

I stop keying for a second, trying to compose a response. "I will, but first I just want to play with the thing ..."

"Wouldn't you save time by reading the manual?"

I have to admit my wife is a little strange—or at least I think so, which may say something about me instead. She even reads the manual for the microwave. But I continued to play with the TiCK®, mastering the commands, and it stayed on the kitchen table ... every time I passed it I would have to sit down and play with the thing.

I had "TiCK fever."

I had sent for the TiCK 2B and had received the package in five days. The one-inch by one and a half-inch board was well marked and had good instructions, complete with the usual beginner's cautions about solder bridges and parts placement.

The heart of the project is an eight-pin PIC® chip that has been programmed as a memory keyer by its creators, Brad Mitchell WB8YGG and Gary Diana N2JGU. Brad and Gary have created several versions of the TiCK, but version 2B had a beacon feature that attracted me because it could have many applications—as a keyer, as a UHF beacon, and even as a tiny foxbox IDer. I had visited Brad and Gary's booth at Dayton, where you could sense their excitement and enthusiasm for their creations.

Building the kit

I built the kit in about an hour. You have the option of using an onboard five-volt regulator or powering the board from a regulated three-to-five-volt source. The audio output can be either via an input to your radio audio chain (which will require some experimenting) or through a piezo element which is supplied with the kit. If you are new to kit building, I recommend that you use the onboard regulator and an external nine-volt battery. Use the supplied piezo element to monitor the audio and to keeps things simple as recommended by the manual, until you get familiar with the TiCK.

When you apply power, if everything is all right the little TiCK talks to you immediately with its identifier message. For the TiCK 2B, it sends the Morse letter "B". Each member of the TiCK family has its own separate power-on identifier.

I was not familiar with any of the earlier versions of the TiCK, so it was a learning experience to set up the different features of the keyer. First, there is not a conglomeration of controls and buttons to activate and there are really no special setup commands that are needed to use the keyer as a basic keyer. It's simple and it works. All of the additional feature commands are given either by input from your keying paddles and or by using a single push-button, which is supplied.

In the instructions, Brad and Gary describe a control system that they have developed. They named it the "Single Button Interface" or SBI. As

described in their extensive instruction sheet, holding down the SBI will allow the user access to the various TiCK functions which are announced by some Morse code abbreviations via the piezo audio output.

The function commands are arranged in a two-tiered system. The first tier is very easily accessed and contains often-used commands such as Speed, Tune, and Memory Play. The second tier of commands is found by entering through the "A" or "Admin" mode, which is on the first tier but allows you second tier access. The A mode's operation is a little more difficult to get the feel for. Once you have arrived in the sequence where you want to be, you quickly release the SBI (button). If you are new to Morse code, you can slow the whole process down with the Speed command, which will make it easier to identify the modes.

The following menu of commands and functions is available on the first tier: Speed, Tune, Memory Play, "A" or "Admin" mode, and "K" ("keyer"). During your experimenting with the board and while roaming throughout the first tier of functions, if you make a mistake or can't figure out what to do, then just stop on the K function. The K mode reverts to normal keyer operation and nothing will change. The second tier of commands and functions contains Memory Input, Paddle Select, Audio On/Off, Straight Key, Iambic mode, and Beacon mode. Again, you have to access the second tier of commands by first selecting the A or "Admin" mode in the first tier. Just build the keyer. You'll figure it out.

The Paddle Select is neat and allows the user to select which paddle is going to be the dit and dah one. The Audio On/Off is useful for those late midnight stealth operations. The Iambic mode can be toggled off, but is by power on default in the on mode. Don't ask me to explain Iambic mode operation, but CW professionals and code fanatics swear by it.

Once you have everything set up, just key when you want. If you want your message played, just push the single button. Great for contesting or just sending a short CQ. Speed change is very easy and has some built-in safeguards. For instance, as you are increasing your speed, you can increase it almost to the speed of light. But to keep from going into never-never-speedland, the keyer will only go so fast before it then retreats from the high-speed end and reverts to the beginning of the lowest speed scale to start over. The genius of this is that if the TiCK remained in the extremely fast area, it would be very difficult to use the menu, as the menu is in Morse code and for some of us it is hard to read code at 50 words a minute. The default speed when you power up is approximate 12 words per minute.

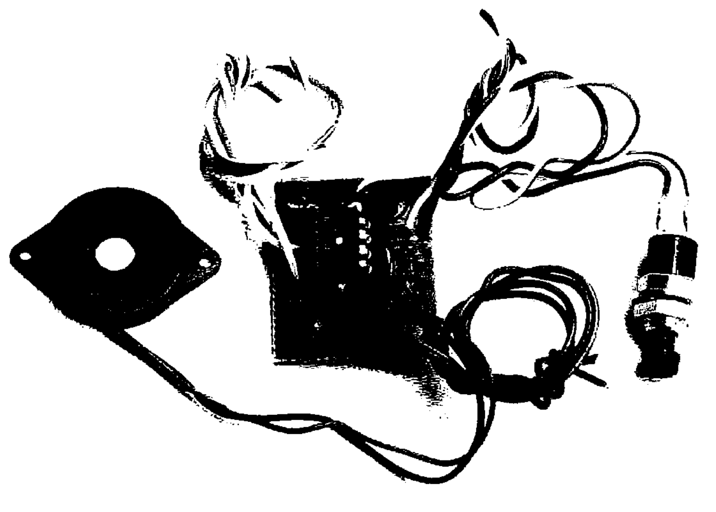


Photo A. The TiCK from Embedded Research. Photo by Emeigh Associates.

The message memory holds a sentence approximately five words long with spaces. When you load the memory, if you pause for a single space, or a series of spaces, the TiCK will pick this up and load the delay space period. The loading of this space period could be useful for foxbox beacons when you have continuous beacon keying and you want your call followed by a silent time period.

Beacon mode

I played quite a bit with the beacon and found the instructions to be a little confusing—probably because I hadn't completely read them in the first place. You have to "toggle" the Beacon mode on with the paddle (either one); to exit the Beacon mode, you have to get back in the menu in the "B" mode and then toggle it off again using the paddle. Once you have toggled the beacon mode on, just hit the single push-button for the beacon to start.

Now, what is neat is that while you are sending the beacon, you can stop it by keying with the paddles and again start it with the push-button. The beacon can be used for those marathon 20-minute CQ sessions without breaking to listen. Some new hams like to do this when they are trying to get everyone's attention or they haven't learned how to receive yet. Again, in normal memory play mode, if you just push the button your message will be played one time. To repeat the message, you will have to push the button again. In "beacon" mode, the message will go on forever until interrupted by the paddles.

Bench testing

During bench testing my unit, I could barely hear very weak harmonics of the internal 4 MHz oscillator up in the 20 meter band near 14.155 MHz and 14.265 while I was keying, and as soon as I released the key the weak signal would disappear. I could not detect any signals on the other HF bands, and used a spectrum analyzer to check the HF segments.

The 4 MHz oscillator is only used when you're keying and does not oscillate when you are not keying. Actually,

when you are not keying the unit goes into a "sleep" mode and draws very little current. Using the onboard 78L05 regulator, I measured less than one milliamp; if one milliamp is too much for you, the instructions suggest using another regulator type for even less power consumption.

When mounting your TiCK in a metal box, you might consider using bypass capacitors on the leads entering and exiting the box and/or using type 43 ferrite material on the leads. This is just a suggestion.

I didn't have any problems keying a 50-watt HF rig and a QRP rig during my tests. Most of the time I was playing with this little board it roamed around my bench or the kitchen table. I really did not handle it very carefully during this month of abuse. The board was not mounted in any enclosure, just supported by its wires. It survived.

When power is interrupted to the TiCK, you will lose your stored information, such as speed, paddle selection, keying modes, and message memory. If you get lost in the menu of commands, you can always disconnect the battery and start over. I experimented with powering the TiCK with a small three-volt lithium battery and used it to power the unit via pin 1 (VCC) of the chip. However, due to the leakage of the supplied onboard regulator, you will have to cut the land on the board from the output of the 78L05 and just let the three-volt battery power the TiCK.

You can diode isolate the output of the 78L05 by installing a diode across the land that you just cut with the cathode end of the diode feeding pin 1 (VCC). With the TiCK running on just the three-volt battery, the current was very low—in the 1 to 2 μA range—so the three-volt battery will last forever in the "sleep" mode.

After I did the diode trick, I discovered on Embedded Research's Web page that they make another TiCK model that has the battery option. That would be the TiCK-EMB kit. This kit has the battery option, the low-current 5 V regulator, and support for enhanced RF immunity, static discharge, and so forth. I don't do a lot of Web page stuff, but go look at the Embedded Research page for full details on the TiCK family at [www.frontiernet.net/~embres/]. The page is well organized, very professional, and updated on a regular basis.

The TiCK unit keys your transmitter with a 2N2222 transistor, which should handle most of the newer radios and certainly most of the QRP units that are being sold. If you are using older vacuum tube radios, then let the 2N2222 bias a larger transistor on and off for keying. The keying was sharp and no transients were noted.

Overall evaluation

Overall, I recommend the TiCK-2B as a first-time project for new hams. It will familiarize you with circuit board construction and soldering. The TiCK is also an excellent project for new hams and old-timers alike with which to familiarize themselves with the new "PIC" technology and at the same time complete a compact memory/beacon keyer that can stand alone or fit in any radio. With thousands of satisfied customers in more than 25 countries, I predict that pretty soon you will see a new bumper sticker: "I love my TiCK."

The complete TiCK 2B kit (catalog number TK2B-DK), consisting of circuit board, parts, and manual, is available for $23, postage paid, from Embedded Research, P.O. Box 92492, Rochester NY 14692. For further information on other kit versions of the TiCK and other products, as well as an order form, see their Web page cited above. 73

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by Oct. 31. Provide a clear, concise summary of the essential details about your Special Event.

OCT 2–3

SPRINGDALE, AR NWAARC HAMFEST '98 will be held at the Jones Center For Families, corner of Hwy. 265 and E. Emma Ave. (north of the airport). General public admitted Fri., 7 p.m.–9 p.m., Sat., 8 a.m.–2 p.m. Setup both days. Admission $5. Tables $6. Tailgate $4. Free parking. Venders, traders, forums. VE exams by pre-registration. For info or reservations, write to *Northwest Arkansas ARC, P.O. Box 24, Farmington AR 72730; or call Sherri Hyde N5UXI* at *(501) 524-4797*. Talk-in on 146.70(-) or 146.76(-).

OCT 3

SYRACUSE, NY The Radio Amateurs of Greater Syracuse will host their 42nd Hamfest Sat., Oct. 3rd, 8 a.m.–2 p.m. at the Pompey Hills Fire Department in the beautiful Pompey Hills suburb of Syracuse, just off Route 20. Admission $5 (16 and older). Indoor flea market $10 with table, or $3 BYO/table. Tables only with advance reservations—no extra tables will be available on site. Outside flea market $3.00. Setup Fri. at 4 p.m., and Sat. at 6 a.m. Tailgaters $3 10 x 20 ft. space, plus admission. Features: breakfast and lunch by the Pompey Hills Fire Dept. Auxiliary; served 7 a.m.–2 p.m. Forums, ARRL, awards, VE exams. Contact *Vivian Douglas WA2PUU, (315) 469-0590* for info; or write *RAGS, Box 88, Liverpool NY 13088;* or check the Web site at *[www.pagesz.net/~rags]*. Talk-in on 147.90/30 MHz.

WILLOW GROVE, PA The Mt. Airy VHF Radio Club ("Packrats") will present the 1998 Mid-Atlantic States VHF Conference at the Hampton Inn, 1500 Easton Rd. (Rt. 611 one quarter mile below the Willow Grove Exit #27 of the PA Turnpike). For room reservations, call (215) 659-3535. Registration is $24 per person at the door. This includes an admission ticket for "Hamarama" being held the following day. Doors are open Sat. Oct. 3rd, 9 a.m.–9 p.m. For additional info, contact *John Sortor KB3XG, 1214 N Trooper Rd., Norristown PA 19403;* or E-mail at *[johnkb3xg@aol.com.]. Tel. (610) 878-5674.*

OCT 4

BEDFORD, IN The Hoosier Hills Ham Club will host its 37th annual Hamfest Sun., Oct. 4th, at the Lawrence County 4-H Fairgrounds located southwest of Bedford IN, on US 50, 1/2 mi. west of the junction of US 50 and State Rd. 37. Talk-in will be on the W9QYQ rptr. 146.730(-) PL 107.2. The gates will open at 5 a.m. EST. Tickets are $6 per person. Dealer setup starts Sat., Oct. 3rd, at 10 a.m. There will be a free chili supper with the purchase of a hamfest ticket on Sat. evening at 6 p.m. There will also be a two-meter foxhunt on Sat. at 3 p.m. on the fairgrounds. Overnight camping available Sat. evening at $8 per vehicle. VE exams at noon on Sun. Please register before noon if you wish to test. More info can be obtained on the Web at *[http://dmrtc.net/~jscheiwe/hamfest.html]. E-mail [jscheiwe@dmrtc.net]* or call *John Scheiwe KB9LTI at (812) 279-0050.*

QUEENS, NY The Hall of Science ARC Hamfest will be held at the New York Hall of Science parking lot, Flushing Meadow Corona Park, 47-01 111th St., Queens NY. Doors open for vendors to set up at 7:30 a.m., buyers admitted at 9 a.m. Free parking. Admission by donation, buyers $5, sellers $10 per space. Talk-in on 444.200 rptr. PL 136.5. For further info call, nights only, *Stephen Greenbaum WB2KDG, (718) 898-5599; or E-mail [WB2KDG@bigfoot.com].*

WARRINGTON, PA The Mt. Airy VHF Radio Club ("Packrats") will hold its annual "Hamarama" on Sun., Oct. 4th, at the Bucks County Drive In, Rt. 611 (4 miles north above the Willow Grove Exit #27 of the PA Turnpike) between County Line Rd. and Street Rd. Doors open to vendors at 6 a.m. for outdoor tailgating; spaces $8 ea. plus general admission charge. Sellers of new and used amateur radio equipment, electronic components, and computer hardware/software vendors are invited to participate. Open to the public at 7 a.m. for a $5 donation. Talk-in on 146.52 simplex. For more info, contact *Mark Schreiner NK8Q, 662 Cafferty Rd., Ottsville PA 18942. E-mail [nk8q@amsat.org] or call (215) 497-1414.*

OCT 10

BREMERTON, WA The North Kitsap ARC will sponsor a Hamfest in President's Hall at Kitsap County Fairgrounds, NW corner of Fairgrounds Rd. at Nels Nelson Rd. Admission $4 for 12 and over, under 12 free. New and used equipment. Tables $15 ea. (and 1 free admission) until 9/30/98; $20 ea. afterwards. Commercial spaces $30. Contact *Susan Johnson AB7MD, P.O. Box 1226, Poulsbo WA 98370, packet [AB7MD@N7WE.#WWA.USA.NOAM]; or E-mail [sujohnso@linknet.kitsap.lib.wa.us].*

EVANS, GA The Augusta Hamfest, sponsored by the ARC of Augusta, will be held at Evans Middle School 9 a.m.–4 p.m. Setup Fri. 6 p.m.–9 p.m. and Sat. 6 a.m.–9 a.m. VE exams start at noon. Contact *Frank at [ks4oc@bellsouth.net], or Terry at (706) 796-7635.* Write to P.O. Box 3072, Augusta GA 30914.

TEANECK, NJ On Oct. 10th, the Bergen ARA will hold its annual "Fall Hamfest" at Fairleigh Dickinson University. Buyer admission is $5, with XYLs and harmonics free. Seller admission $10. VE exams will be featured. Take Rte. 4 east/west to the River Rd. exit. Follow the signs into the hamfest area. Talk-in on 146.790 (-600). For further info call *Jim Joyce K2ZO at (201) 664-6725 before 10 p.m.* Please, no calls after 10 p.m.

OCT 10–11

MEMPHIS, TN The Greater Memphis Amateur Radio and Computer Show, "MemFest '98" will be held at 2585 N. Hollywood at I-240 in Memphis, Oct. 10th and 11th. The event is open on Sat. 8:30 a.m.–4 p.m., and Sun. 8:30 a.m.–2 p.m. Admission $5 at the door. Non-ham activities, ladies' activities and VE exams (both days) will be featured. Flea market tables are $25 each; dealer booths are $55 each. Talk-in on 146.22/.82. Send correspondence to *MemFest '98, P.O. Box 751841, Memphis TN 38175-1841.* The event is sponsored by the Greater Memphis Amateur Radio Operators. For general info, contact *Lee Bowers KA4KVW, (901) 867-3461, or Ben Troughton KU4AW, (901) 372-8031.*

TAMPA, FL The Egypt Temple ARA will host their 2nd annual Hamfest and Computer Show in the Unit Building located at 4050 Dana Shores Drive, Tampa FL. There will be 60 tables available at $15 each for the two-day event, 18 of which will be against the wall with standing room behind and aisle space in front. Each table will have two chairs. Admission tickets required by all except children under 10 years of age. Electricity will be available but customers must supply their own cable. Table reservations and tickets can be obtained from *J.F. Strom K9BSL, 233-34th Avenue North, St. Petersburg FL 33704-2241. Tel. (813) 822-9107.* No food or drink allowed except that being sold by Egypt Temple members.

OCT 11

MASON, MI The LCDRA and CMARC Hamfair Swap & Shop will be held 8 a.m.–1 p.m. at the heated Community Center in the NW corner of the Ingham County Fairgrounds in Mason MI. This building is easily accessible to the physically challenged and has ample handicapped parking. From I-96, take Exit 106 (US 127) south to the Kipp Rd. Exit. You can follow the signs in from Kipp or use the talk-in at 145.390. Alternate directions: Take 127 to the Cedar St. exit for Mason. Head south on Cedar to the 2nd light, which is M-36. Turn left (east) and travel through downtown area,

past the courthouse. Continue east on M-36. just outside of town to the fairgrounds. The main gate will have a sign and personnel to guide you in from there. Admission $5 per person. Tables $10, trunk sales $6. Overnight camping available. Vendor setup 6 a.m. Contact *Don WB8NUS at (517) 321-2004. or LCDRA. P.O. Box 80106. Lansing MI 48908.*

WALLINGFORD, CT The Nutmeg Hamfest and Computer Show, featuring the ARRL Connecticut State Convention, will be held 9 a.m.–3 p.m., rain or shine. at the fabulous "Mountainside Special Event Facility." KJI Electronics, Lentini Comm. and other major vendor displays. VE exams. Register in advance by calling *Joel Curneal N1JEO, (203) 235-6932.* Free parking. Inside selling space includes one 10 x 10 ft. booth, one 8 ft. table, one chair (two free vendor passes per booth). $20. Outside, one tailgate 30 ft. space. $15. General admission $6 (children under 12, $3). Make checks payable to *Nutmeg Hamfest* and send to *Gordon Barker K1BIY, 9 Edge Wood Rd., Portland CT 06480. Tel. (860) 342-3258.*

OCT 18

CAMBRIDGE, MA A tailgate electronics, computer and amateur radio Flea Market will be held Sun., Oct. 18th, 9 a.m.–2 p.m. at Albany and Main St., Cambridge MA. Admission $4. Free off-street parking for 1000 buyers. Fully handicapped accessible. Tailgate room for 600 sellers. Sellers $10 per space at the gate, $9 in advance—includes one admission. Setup at 7 a.m. For space reservations or further info, call *(617) 253-3776.* Mail advance reservations before Oct. 5th to *W1GSL. P.O. Box 397082 MIT BR.. Cambridge MA 02139-7082.* Rain or shine! Covered tailgate area available for all sellers. Talk-in on 146.52 and 449.725/444.725 PL 2A, W1XM rptr. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

KALAMAZOO, MI The 16th Annual Kalamazoo Hamfest will be held at the Kalamazoo County Fairgrounds. Free parking. The Kalamazoo ARC and the SW Michigan AR Team are co-hosting this event. Vendor setup is at 6 a.m. Doors open to the public at 8 a.m. Advance tickets $3. $4 at the door. Trunk sales $5. Tables $1.50 per ft., 4 ft. minimum. Electrical hookup $5. For tickets/tables, send SASE to *Gary Hazelton N8GH, 75075 M-40, Lawton MI 49065.* For contact or info see the Web site at *[www.net-link.net/wmat].* E-mail inquiries to *[ka8blo@net-link.net].* Talk-in on 147.040 K8KZO rptr.

SELLERSVILLE, PA The RH Hill ARC will host their Hamfest at the newly rebuilt Sellersville Fire House. on Rt. 152. 5 mi. south of Quakertown and 8 mi. north of Montgomeryville. Admission is $5. VE exams 10 a.m.–1 p.m. for all classes. Bring documents. Indoor flea market spaces $12, table included. Outdoor spaces $6, bring tables. Contact *Linda Erdman, 2220 Hill Rd., Perkiomenville PA 18074:* or call her at the *Hamfest Hotline. (215) 679-5764.* The club maintains a Web site at *[http://www.rfhill.ampr.org].*

OCT 24

GRANDVIEW, MO "Octoberfest '98" will be held by the Southside ARC Sat., Oct. 24th. 8 a.m.–2 p.m. at Grandview Middle School (East Junior High). 12650 Manchester. in Grandview MO. VE exams start at 10 a.m.; you must be pre-registered! Code test 10 a.m.–11:20 a.m. Written test 12 noon–1 p.m. Mail your completed 610 to *Exam Registration. P.O. Box 12757. North Kansas City MO 64116.* Tickets are 4 for $5 in advance, 3 for $5 at the door. Single tickets $3. Tables are $15 each, includes one ticket. For tickets, tables, or info, contact *Donna Quick KBØYJN. (816) 537-7464. E-mail [kbOyjn@juno.com]: or Mark Sevy KBOVWD, (816) 331-8948. E-mail [kbØvwd@juno.com].* or write to *SSARC. P.O. Box 701. Grandview MO 64030.*

RICKREALL, OR The Mid-Valley ARES will present its 4th Annual "Swap-Toberfest," Amateur Radio Emergency Services Convention, Sat. Oct. 24th. at the Polk County Fairgrounds in Rickreall OR. Doors open for the convention from 9 a.m. to 3:30 p.m. the day of the event. Swap table setup will be 6 p.m.–9 p.m. Fri. night, Oct. 23rd, and on Sat. morning, Oct. 24th. at 7 a.m. Features include swap tables, commercial dealers, meetings, and seminars. Emergency Communications Vehicles will be on display from Marion and Polk County Emergency Management, Civil Air Patrol, American Red Cross, the Oregon State Police. and others as available. Self-contained RV spaces are available. For more information, contact *Bob Boswell W7LOU. (503) 623-2513,* or E-mail to *[w7lou@goldcom.com].* To download a copy of the flyer and pre-registration form, surf the net for *[http://www.teleport.com/~n7ifj/swaptobe.htm].* Handicapped hams who have pre-registered may enter Swap-Toberfest at 8 a.m. through the East Door. One pre-registered assistant per handicapped ham may accompany to offer a helping hand.

SUMTER, SC The Sumter ARA's 12th Annual Hamfest and Computer Fair will be held 8 a.m.–4 p.m. at the Sumter County Exhibition Center, 700 W. Liberty St., Sumter SC. Advance tickets are $5, $6 at the door. For advance tickets send check and SASE to *SARA, P.O. Box 193, Sumter SC 29151-0193.* Advance ticket requests received after Oct. 17th will be held at the door. For dealer packages or more info. contact *Steve Heriot KC4ZLB, 115 S. Washington St., Sumter SC 29150-5127. Tel. (803) 773-2282; E-mail [sheriot@ftc-i.net];* or contact *Greg Czerniak W4GRC, 2220 Highway 261 S., Wedgefield SC 29168. Tel. (803) 494-5565; E-mail [grcljc@ftc-i.net].* Talk-in on 147.015.

OCT 24–25

EL PASO, TX The 1998 International Hamfiesta and Computer Show will be held at the Ysleta Independent School District's Cultural Arts Center, 9600 Sims St., El Paso TX, Sat. 8 a.m.–5 p.m., Sun. 9 a.m.–2 p.m. Pre-registration $5. At the door, $6. Swap tables $10 with Fri. setup. Tables $12 at the door. Computer upgrading. VE exams both days. There will be forums on ARRL, packet radio, Internet communications, QSL verification, and satellite tracking. RV overnight hookups nearby. QCWA breakfast. Contact *Clay Emert K5TRW, P.O. Box 971072, El Paso TX 79997. Tel. (915) 859-5502. E-mail [cemert@dzn.com].*

NOV 1

CANTON, OH The Massillon ARC will sponsor "Hamfest 98," Sun.. Nov. 1st, at the Stark County Fairgrounds. 305 Wertz Ave. NW. Canton OH. Vendor setup at 6 a.m. Doors open to the public at 8 a.m. General admission $5, $4 in advance. Tables are $10 each. Info and reservations to *MARC, P.O. Box 73, Massillon OH 44648.* Include an SASE. An auction begins at 10 a.m. Talk-in on 147.18(+) rptr. E-mail to *[marc.hamclub@juno.com].* or call *Terry Russ (330) 837-3091 before 10 p.m.*

DES MOINES, IA The Tikva Tracers ARC "Hamfest Iowa '98" will be held at the 4H Building, Iowa State Fairgrounds. in Des Moines. Setup Sat. 6 p.m.–9 p.m.,

and 6 a.m. Sun. Doors open al 8 a.m. Seminars and "Ask the Experts" will be among the featured goodies. Talk-in on 146.22/.82. Admission $5, first table $10, each additional $8, electric $8. VE exams at 9:30 a.m. Contact *Randal Lees NØLMS, 1575 Northwest 78th St., Clive IA 50325-1255. Tel. (515) 279-4241; E-mail [rclees@raccoon.com].*

NOV 7

ENID, OK The Enid Hamfest Group will hold the Enid Hamfest at Oxford & 4th Streets, at the Garfield County Fairgrounds (Hoover Bldg.), 8 a.m.–5 p.m. Admission $2, tables $1 each. Special features: Free doughnuts and coffee in the morning, free hotdogs and soda at noon. VE exams at 1 p.m. Contact *Tom Worth N5LWT, (580) 233-8473, E-mail [N5LWT@HOTMAIL.COM]*; or *Fred Selfridge N5QJX, (580) 242-3551; E-mail [FREDNNEL@IONET.NET]*. Talk-in on 147.15(+) or 444.400(+)

SORRENTO, FL A Hamfest, Computer Show and Electronic Expo will be hosted by the Lake ARA, Nov. 7th at the East Chamber of the Commerce Building in Sorrento FL. Admission $5; vendor cost is $10 (includes one admission). Setup Fri., Nov. 6th, at 3:30 p.m.–6 p.m.; Sat., Nov. 7th, at 6 a.m.–8 a.m. VE exams (walk-ins only) at 10 a.m. For info and table reservations, contact *Chuck Crittendon KA4EXM. P.O. Box 615, Altoona FL 32705. Tel. (352) 669-2075.*

WAUKESHA, WI The Milwaukee Repeater Club will sponsor the 14th annual "6.91 Friendly Fest" on Sat., Nov. 7th, 8 a.m.–1 p.m. at Waukesha County Expo Center Arena Forum, N1 W24848 Northview Rd., Waukesha WI (I-94 to County J, south to FT, west to Expo). Sellers admitted at 5:30 a.m. Tickets $5. 4 ft. tables $5 each. Please call *Mike KB9PHA at (414) 258-4435.* Send an SASE with payment to The *Milwaukee Repeater Club, P.O. Box 2123, Milwaukee WI 53201.* There will be VE exams on-site. Talk-in on 146.91(-) (The Friendly Repeater), and on 146.52. Visit the Club's Web site at *[http://www.execpc.com/~mrc/friendlyfest.htm].*

NOV 8

KAUKAUNA, WI The Fox Cities ARC will present its annual Hamfest at the Starlite Club, comers of Hwy. 55 and Cnty. Rd. JJ. You must buy an admission ticket if you pre-register. Advance admission tickets $4 ea., 8 ft. long tables $8 ea. Send check or money order payable to *FCARC, 1912 Russett Ct., Appleton WI 54914, Attn: Chad Pennings N9PRC, Hamfest Chairman, tel. (920) 993-0485.* Registration for VE exams is 8 a.m.–9 a.m., no walk-ins after 9 a.m. Bring original license plus two copies, and a photo ID. For more exam info contact *Larry Siebers KD9IA, (920) 757-1167.* Talk-in on 146.52 simplex.

SPECIAL EVENT STATIONS

OCT 3

LAWRENCEVILLE, GA Gwinnett ARS will operate Station W4G 1400Z–2200Z on Oct. 3rd, in conjunction with the "Air Fair & Fall Classic Biplane Fly-in" being sponsored by the Experimental Aircraft Assn. (EEA) Chapter 690. Operation will be in the General portions of 40, 20, 15, and 28.450 on 10 meters. For a certificate, QSL to *GARS, P.O. Box 88, Lilburn GA 30048.*

OCT 3–4

HILTON, NY The Brockport ARK will operate a special event station to celebrate the 18th annual Apple Festival from Hilton NY. K2BRK will operate in the General class portion of the HF bands as well as 2m and 70 cm. from the festival site in Monroe County, grid square FN13. BARK will acknowledge contacts with either a postcard QSL or an 8.5- x 11-inch certificate to all verified stations that send an SASE. The QSL manager for this event is *John D. Hysell KF2XC, 381 Fiesta Rd., Rochester NY 14626-3843.* Visit the BARK Web site at *[www.frontiernet.net/~n2tuk]* for more details and updates.

OCT 4

PITTSBURGH, PA The *USS Requin* ARC will operate NY3EC from the submarine *U.S.S. Requin*, docked at the Carnegie Science Center of Pittsburgh. They will be on the air 1400Z–2100Z Oct. 4th. The station will operate vintage CW equipment in the 40 meter Novice band, and in the Novice portions of the 10 and 15 meter bands, if conditions permit. Phone operation will be in the General class segment of 20m and 40m. For a certificate and QSL card, send QSL and an 8-1/2- x 11-inch SASE to *Jack Buzon KA3HPM, 47 Grubbs Rd., Cheswick PA 15024-9648.*

OCT 11–NOV 7

MINNEAPOLIS, MN The 1998 Plenipot Meeting, being held Oct. 12th–Nov. 7th, will be accompanied Oct. 11th–Nov. 7th by special event station W98ITU, operating from Minneapolis MN. QSL cards are available from *W98ITU, P.O. Box 131415, St. Paul MN 55113.* Remember to send an SASE. DX cards will be handled directly or through the W9 bureau. Operation will be on all HF bands, CW, phone and RTTY. Novice band operations are also being planned.

OCT 17

WILMINGTON, NC The Azalea Coast ARC will operate AC4RC 10 a.m. EST–3 p.m. EST from the original radio room of the Battleship *USS North Carolina BB 55.* Connect with them on 7.250, 14.250, 21.35, 28.400. QSL *AC4RC, P.O. Box 4044, Wilmington NC 28406.* The club will also be hosting a JOTA event from the Battleship Park gazebo 10 a.m.–3 p.m.

OCT 17–18

JACKSONVILLE, IL The Jacksonville ARS will operate K9JX Oct. 17th and 18th, to mark the club's 40th Anniversary. Operation will be in the General portion of 10–80 meters. For a certificate send an SASE and contact info to *K9JX, 773 E. College Ave., Jacksonville IL 62650.*

LETTERS

continued from page 6

graduates ought to read it. It's only 110 pages long and has more meat in it than most of the courses they take. I tend to agree with you that your quote "the marketplace is the battlefield" is not far from the truth.

Jim Parker ABØEZ. Thanks for publishing my letter to *73* in the April 1998 issue. To date, I have received a grand total of *one* response via my E-mail address ... and that chap agreed with me! I thought that my letter might provoke a bunch of angry, hairy-chested, macho ham responses defending the ARRL and CW. It appears that I was wrong. Perhaps I have just been dismissed as a kook or a troublemaker not worth the time it takes to respond. Or perhaps we should all just be quiet, pay our League dues, and follow the leader like a good bunch of sheep!

Let me share with you a brief synopsis from a local club meeting I attended where an ARRL representative spoke. This gentleman first stood up and shared with us how the League was going to ensure that the CW requirement for HF operation would remain in place. Indeed, our trusty League official spoke of how it was our collective moral duty to ensure that this tradition (hazing) stayed in place.

Then the conversation shifted to the VHF and above area. Our elected official then informed us that it was time to think about junking our antiquated analog repeaters and handie-talkies (which are already in place, relatively cheap, and work!) for digitally encoded trunking systems! When asked, the main reason given for the encouraged change was "for efficient spectrum use." This is pure baloney! Wayne, we don't even use 10% of the frequencies we as hams have allotted above 29 MHz. Just try and buy a piece of commercial ham equipment for use

Number 39 on your Feedback card

Hams With Class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

School demos—a great experience!

In the enlightened times of the 1990s, most hams have come to realize the importance of encouraging young people to become involved in the hobby and service of amateur radio. There are lots of exciting approaches and opportunities to expose children to the fun and challenges of becoming a radio operator if only we are prepared and use a little creativity in our thinking.

We've all read about the efforts of resourceful clubs, dedicated parents and teachers, and individual hams who have introduced many youngsters to our hobby by inviting them to observe and participate in Field Days, fundraisers, community events, and other club activities. As a teacher myself, I've always tried to take advantage of invitations to speak at PTA meetings, to conduct teacher workshops, and above all, to do live demonstrations in different classrooms in other schools.

Last June I was visiting with some non-ham friends on Long Island, New York. There were two very bright, articulate little boys in the family who were telling me about all the many activities they're involved in, both in school and in the afternoons and evenings. Bradley is in the first grade in the Franklin School in Hewlett. Zachary is in kindergarten in the same school.

Even though there is a heavy emphasis on sports in the Parker family, both parents and a doting uncle are all educators who encourage the boys to be well-rounded in their interests. They are all open-minded and totally committed to the children's educational experiences.

Could I ask for a better opportunity? As soon as I volunteered to come to the school and do a ham radio demonstration, Larry Parker contacted his son's school to get permission for me to come there. Having done school demos for the past 20 years, I know the importance of being prepared. Many of my "Hams With Class" columns have been devoted to the absolutely necessary step of good preparation. At least 50% of the letters that I receive deal with the question of how to approach school administrators to get permission to come into a school to demonstrate ham radio. *Good preparation* is the key to success with anything, in my opinion—especially when going before busy administrators, parent groups, and classroom teachers.

Once we were in agreement on the date, I prepared a package of information for the teacher, Mrs. Fenton. The more aware the classroom teacher is of what to expect during your visit, the better the presentation will be. There are lots of classroom materials available from the ARRL for teachers. Simply contact the educational activities department at 225 Main Street, Newington CT 06111, and tell them of your plans.

My next step was to contact my good friend, Rob Todaro N2JIX, who is the president of the LIMARC radio club on Long Island. He immediately put me in touch with several ham radio operators who were local to the Hewlett school. Plans were made for both simplex and repeater contacts. A good piece of advice is to always have a backup plan in case you encounter problems.

***Photo A.** Carole WB2MGP puts Bradley Parker on the air.*

Upon my arrival at the Franklin School, I was greeted by Ms. Joyce McGinn, the principal. I was delighted to learn that her brother had been a ham as a young boy, so she was somewhat familiar with the positive points of amateur radio. She was impressed with the concept of using the radio in the classroom to teach school curricula. I was so pleased when she came into Mrs. Fenton's room to observe the demonstration lesson I gave to two first-grade classes.

I showed the children a rolled-out plastic QSL card holder, containing colorful cards from contacts from all over the world, that I had taken from the wall of my own classroom. I showed them my two-meter rig and let Bradley Parker make the first contact on the air (**Photo A**). I knew enough to vary the activities at a rapid rate due to

Continued on page 40

***Photo B.** Mrs. Fenton, Carole WB2MGP, and a roomful of eager first graders.*

on the 900 MHz band other than a scanner! Even if you could buy a ham transceiver for 900 MHz, what would you hear? Silence! Yeah, and we really use the daylights out of 1.2 GHz, too ... *NOT!*

How many 1.2 GHz repeater systems are there in your home town? We have two in the Denver area and they are almost always silent, except for a computer-generated identification. Boy, I can really see the need for a trunking system on that band! Let's see, keep a 100-year-old communication method as a requirement for worldwide communications (no matter if you intend to use that method or not!) but junk existing and working communications systems for something new? I think not on both counts.

If this is the thinking from the top down via the ARRL, then amateur radio as a whole in America is in serious trouble, even worse than I had thought before. We obviously need to get some new blood elected into the ranks of the ARRL in a desperate way! Before I get bashed, let me say, once again, that I personally love CW, am a VE, am an ARRL member, and would like to see amateur radio survive until I am one of the Old-Timers! 73

Number 40 on your Feedback card

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

***Photo A.** The SSTL team in Moscow during spacecraft integration with* FASat-Bravo *on the left and* TMSAT-1 *on the right. Chris Jackson G7UPN in the center. (SSTL photo)*

On July 10, two new hamsats achieved orbit, thanks to a *Zenit-2* launch vehicle from the Baykonur cosmodrome. *TMSAT-1* and *Gurwin-II Techsat* made it to space without mishap, and are functional. The orbit is about 820 km (500 miles) high and inclined 98.8 degrees. The satellites travel over the poles and come within view about the same time every day due to the sun-synchronous orbit. Their primary amateur radio activity will be digital 9600-baud store-and-forward communications.

The launch

The primary payload on the Russian *Zenit-2* launcher was the *Resurs-01 No. 4* satellite. It is a Russian civil remote sensing satellite similar to a US Landsat, but based on the Russian Meteor weather satellites. It was built by VNII Elektromekhaniki and some sources have reported that it may later be labeled as *Resurs-02 No. 1*. An integral part of the *Resurs* spacecraft is the Belgian LLMS (Little Leo Messaging System). It is to be used as part of the IRIS communications system.

There were four secondary satellites onboard. The two non-ham spacecraft included *FASat-Bravo*, a 50-kg test satellite built for the Chilean Air Force by Surrey Satellite Technology, Ltd. (SSTL) in England and *Safir-2*, a 60-kg relay satellite built by OHB in Bremen for the German Space Agency.

TMSAT-1

Built at the University of Surrey, *TMSAT-1* (Thai Micro SATellite) is almost identical in appearance to the Chilean *FASat-Bravo*. *TMSAT-1* was built in a cooperative agreement between SSTL and the Thai Micro Satellite Company, Ltd. (TMSC) of Bangkok, Thailand. TMSC was created by the Mahanakorn University of Technology (MUT) and Thai Satellite Communication (TSC). The satellite carries a number of experiments and systems. The Earth observation camera and data communication payload are the primary focus of amateur radio interest.

The imaging system includes one wide-angle camera and three narrow-angle units (infrared, red, and green). The wide-angle camera has a field of view of 1500 x 1500 km, producing an image 576 x 576 pixels. The narrow-angle unit sees a 100 x 100 km area and provides a 1024 x 1024 pixel image. Pictures that are taken by the cameras will be available via the 9600-baud amateur downlink.

The communications system includes three two-meter uplink frequencies coupled to one of two 70-cm downlink frequencies. The primary downlink frequency is 436.925 MHz. In addition to the 9600-baud downlink, the satellite has an onboard digital signal processing (DSP) system that can allow real-time voice communications, experimental digital modems, a digital voice broadcaster, and other as-yet unspecified activities. The *TMSAT* home page on the Internet can be found at the Universal Resource Locator (URL) of: [http://www.ee.surrey.ac.uk/CSER/UOSAT/missions/tmsat/index.html].

Gurwin-II Techsat

The Techsat project to study satellite systems began seven years ago as a senior project for

---

HAMS WITH CLASS

continued from page 39

the short attention span of first graders.

I observed wide grins as I showed a few minutes' worth of a video taken of the students in my class talking on the radio in our classroom ham shack to a one-room schoolhouse class on an island off the coast of Maine. And they all were enthralled with the footage of our SAREX ATV contact with the space shuttle *Challenger* in 1985.

I brought photo albums and colorful posters from some of our more memorable contacts to show the children. I showed them photos and a box filled with souvenirs from the Navajo Indian School in Sun Valley, Arizona, that we've been speaking to through the years.

Next, I showed them QSL cards and video footage of some of the very young children who made presentations at my youth forum at the 1998 Dayton HamVention. It's an important point to make that children always enjoy watching other children having a good time in a classroom setting and doing unusual things.

The time went by so quickly that before we knew it, the hour was up and I barely had enough time to answer their questions and give out souvenir Kenwood caps and ICOM magnets.

It was such a kick for me to watch a class of first graders, lined up to go on the school bus, all wearing ham radio caps and yelling "88s!" to me as they hurried onboard the bus to tell the other kids about the exciting lesson they had just had.

The teacher has already invited me to return next term and address new classes. Many of the parents gave very positive feedback about how excited their children were when they got home from school that day.

The best way to prepare for speaking to the elementary level classes is to have a multimedia presentation, keep the topics brief and exciting, and have lots of visuals.

It will always be a big hit if you distribute nice souvenirs to the children when you leave. Also, make sure the teacher whose class you've been visiting is left with information sheets containing a number where you can be reached for further information.

Above all, remember that the enthusiasm *you* have for the hobby is what will get transmitted to the students. This is what ultimately will get them interested and eager to learn more. 73

Photo B. Chris Jackson G7UPN and TMSAT-1, *with the main payload* Resurs-01 #4, *during spacecraft integration in Moscow in April. (SSTL photo)*

aerospace engineering students at the Technion Israel Institute of Technology in Haifa, Israel, under the guidance of Professor Haim Eshed. Later, the program was expanded to develop and launch a series of satellites designed and built at the Technion. Work on the program was organized by Professor Giora Shaviv, the head of the Asher Space Institute (ASI). The first satellite, *Techsat-1*, was destroyed (along with the first hamsat from Mexico) when the launcher, a converted Russian ICBM, malfunctioned in 1995.

The second satellite in the Techsat series, *Gurwin-II Techsat*, represents not only a replacement for *Techsat-1*, but also offers more experiments and capabilities. The satellite is named after the distinguished American Society for Technion (AST) leader Joseph Gurwin and the late Rosalind Gurwin.

In addition to an imaging system and the amateur radio communications package, *Gurwin-II Techsat* has a number of interesting experiments. The satellite carries a UV photometer operating in the 0.24–0.30 mm spectral region to investigate ozone concentrations over the Middle East and to test the capabilities of a small, low-power system for use in space. Another experiment is a charged-particle detector to measure protons and heavy ions in space that cause single-event upsets in electronic devices. There is also a superconductivity experiment that will be used to see if such a device can survive launch and how long it can operate unattended in a space environment. A small X-ray detector has been incorporated into the satellite as a step toward later development of a simple X-ray telescope. An array of reflectors is attached to the outside of the 48 kg satellite to allow the use of Satellite Laser Ranging (SLR) techniques. An Earth-based laser is used to measure the trip time for laser pulses sent from the ground. Distance measurements can achieve an accuracy of five to 10 centimeters (two to four inches).

Photo C. Commissioning the TMSAT-1 *Bangkok control station HSØAM. From left to right: Chatpetch, Pavinee, Chris Jackson G7UPN, and Withaya HSØECQ.*

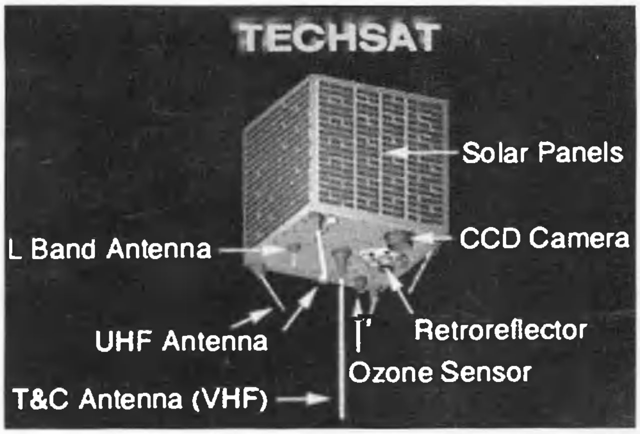


Photo D. The Israeli Gurwin-II Techsat *satellite configuration. (Technion Israel Institute of Technology)*

The imaging system on *Gurwin-II Techsat* is simpler than that on *TMSAT-1*, but still represents a unique opportunity for hams to view pictures taken from orbit. It uses a CCD (Charge Coupled Device) video camera in conjunction with an image processing and control card. When commanded from the ground, the camera can capture an image, digitize it, compress it, and store it for later transmission.

The amateur radio package is similar to other satellite based store-and-forward systems, but with one significant difference. The three uplink frequencies are in the 23-cm band, just below 1270 MHz. A single downlink is provided on 70 cm at 435.325 MHz. The system is capable of operation at either 1200 baud or 9600 baud. After initial tests are complete, the 9600-baud downlink/uplink will become standard. The *Gurwin-II Techsat* home page can be found on the Internet at the URL: [http://techsat.internet-zahav.net/].

Both new hamsats represent significant additions to the growing fleet of digital resources in orbit, and point out the global cooperation now in place among like-minded satellite enthusiasts. Who would have believed that a Thai hamsat built in England and an Israeli hamsat from Haifa would go to orbit together, on a Russian rocket?

Field Day 1998

Once again the low-Earth-orbit hamsats like *Fuji-OSCAR-20*, *Fuji-OSCAR-29*, *RS-12*, *RS-15*, and *AMRAD-OSCAR-27* were called upon to carry a large part of the 1998 Field Day communications. There was, however, a big surprise that few expected. *AMSAT-OSCAR-10*, now 15 years old, was online and working great. In the months prior to Field Day (always the 4th weekend in June), communications through *A-O-10* had been difficult. The satellite's onboard computer has been dead for more than 10 years, but when the spacecraft is oriented with good solar cell illumination, the Mode B (70 cm up and

Photo E. Picture of Neve-Shaanan in Israel taken by a Techsat satellite during tests. The Techsat-II *satellite will take pictures of the Earth from orbit. (Technion photo)*

Photo F. Field Day can get hot in central Texas. The K5DX hamsat team had a cool time with K5BXX's RV.

Photo H. The author, Andy W5ACM, listens for more satellite contacts during Field Day 1998 at the K5DX site.

two meters down) analog transponder works reasonably well. For Field Day, the illumination was almost perfect and the satellite's orbit made a very favorable pass over North America. From its apogee, or orbital high point, signals were a bit difficult, and deep fades were a problem, but when the satellite was closer in (less than 25,000 km), signals were good and the fades less noticeable. The bulk of the analog Field Day contacts were made through this satellite that just won't give up. Operators were surprised and delighted.

The digital satellites, especially those capable of 9600-baud operation, were very busy during Field Day. Field Day greeting messages were logged from around the world. *KITSAT-OSCAR-23* carried the most, with *KITSAT-OSCAR-25* and *UOSAT-OSCAR-22* close behind. *AMSAT-OSCAR-16* and *LUSAT-OSCAR-19* were also active at 1200 baud.

Photo G. Mike WA5TWT arranges the coax feeds to the VHF and UHF satellite antennas at the K5DX Field Day site.

Unlike the American Radio Relay League Field Day rules that consider "satellite" a single band, the AMSAT (Radio Amateur Satellite Corporation) rules state that each satellite is a separate band. This encourages operators to chase all the satellites, and not just the easiest one. The AMSAT rules also encourage the use of the digital satellites for Field Day message forwarding and message collecting. Under the AMSAT rules, it is actually possible to get a decent score without ever transmitting, just by receiving Field Day greeting messages broadcast from the digital satellites. Foreign operators are also encouraged to participate on an even basis with American and Canadian stations.

The Houston AMSAT Group teamed up with the Texas DX Society (TDXS) for a weekend of hot weather, air-conditioned motor homes, BBQ and lots of HF and hamsat contacts. A new Yaesu FT-847 was used for all of the satellite activity. All of those who tried their hand at the new rig from Yaesu enjoyed it, and found it easy to use. Although we didn't have the wiring correct to uplink messages to the digital satellites, we did manage a large number of downloads and made mostly voice and CW contacts via *A-O-10* and the other analog satellites. It was a Field Day to remember.

The AMSAT Annual Meeting and Space Symposium

It's time again for the AMSAT-NA Space Symposium and Annual Meeting. This year, it will be held at the Battlefield Inn (formerly the Park Inn) in Vicksburg, Mississippi, from October 16th through the 18th. Compared to other conventions and events, the rates for AMSAT gatherings are extremely reasonable.

Registration is $30.00, the Saturday night banquet is $20.00, and a Sunday morning field trip to the US Army Engineer Waterways Experiment Station is $10.00. To register, call AMSAT at (301) 589-6062.

Room rates are $52.00 for a single and $62.00 for a double per night. A complimentary breakfast buffet is included. For reservations at the Battlefield Inn call 1 (800) 359-9363 and mention the AMSAT Conference.

Southwest Airlines is the official airline of the AMSAT Conference and will provide a 10% discount on airfares. To make airline reservations, call 1 (800) 433-5368 and reference K3308. Flights go into the Jackson (Mississippi) airport. A shuttle service is available for $9.00 each way.

You can check all this out on the Internet via the URL: [http://pages.prodigy.com/DXHF93A]. The talk-in frequency at the conference is on the 147.27 MHz repeater (100 Hz PL). Some family activities will be provided, and Vicksburg has many interesting sites to tour, including Civil War battle scenes and antebellum mansions. From casinos to campgrounds, they have it all. I'll see you in Mississippi!

Photo I. Doug WB5TKI collects a few more CW contacts via A-O-10 *during the 1998 Field Day operation.*

Number 43 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[pangen@compuserve.com]

Over the past few months, I've noticed quite a few more mobile HF stations on the air. I attribute this to our improving sunspot cycle. With better propagation, I can hear (and work) more stations of all types, including mobiles. On the other hand, I sense that more hams are adding HF mobile capability because of the improved propagation. People are more interested in investing time and effort into selecting and installing new mobile rigs when the chances are good that they will be able to work interesting and DX stations. To all of you who have either added HF or are thinking of adding it—Welcome!

I'm still operating my trusty Kenwood TS-130S, and though its features are modest, I'm able to operate it almost entirely by touch with only the occasional glance at the control panel. However, I do find many of the new rigs absolutely fascinating, with features including memories and expanded coverage from 80 meters to VHF. Regardless of the type of rig, though, successful HF mobiling depends to a great extent on how attentive one is to details, especially when installing the rig. A couple of extra hours' work in the beginning will pay off in big performance benefits.

Years ago we learned that a good electrical connection starts with a good mechanical connection. In mobile operations, this is especially good advice. In the event of an accident, a good mechanical connection between the rig and the vehicle will minimize the chance that the rig will become a missile ricocheting around the passenger compartment. An object in motion (your radio) tends to remain in motion (even if the car in which it is installed has abruptly stopped) until another force (hitting something or somebody) overcomes it. As they say, physics isn't just a good idea—it's the law (... sorry about that).

Most rigs have the chassis and/or case at the same potential as the car chassis or body—normally negative. The car uses the body as the negative lead for most circuits, as do most radios. The radio also may use the chassis to connect to the braid of the antenna lead. Even though many radio mounting brackets provide no electrical connection to the car, I believe this is important. The radio may be mounted within rubberized clamps, but this is more for vibration protection than electrical isolation. I try to mount my HF rig to the car body with metal brackets that provide both a mechanical and electrical connection. Also, this may improve your insurance coverage on your rig. Some policies pay a higher amount for theft of a permanently-installed piece of equipment than for a temporary installation. Check your policy to see if this applies to you.

Power connections can sometimes get a good discussion going among hams. With my UHF and VHF equipment I try to have a good connection for power, but I do keep a power cord available that will let me plug the radio into a cigarette lighter in an emergency. This is not appropriate for HF installations, and a connection directly to the battery is recommended. First, HF rigs tend to run around 100 watts, while a VHF or UHF transceiver usually will be between five and 50 watts. Second, VHF and UHF mobile operations tend to use FM as the mode of choice, and FM is inherently less sensitive to noise. HF operations use one of the sidebands of an AM signal, and electrical noise is much more of a factor.

When it comes to actually wiring the power cord, some swear to the benefit of fusing only the positive lead. Others believe that both leads should be fused. I admit to being guilty of blowing both fuses (in my much younger days, of course), so I subscribe to the two-fuse theory. Remember that a point in a circuit is positive or negative in relation to some reference point, so a negative lead in relation to the positive lead may in fact be positive in relation to some other reference, and if they touch, you may wish you had that second fuse.

Many of the panels in an automobile are not connected together in an optimal manner, and this produces a lot of noise. While noise blankers do a marvelous job, they are merely an attempt to treat a symptom of a larger problem. Remember that "signal-to-noise ratio" really means (signal + noise)/(noise). If all of the body panels can be better connected, overall noise may be reduced. This can be done in a few hours by ensuring that all the panels are mechanically and electrically connected. A noncorroding sheet-metal screw can be used to connect panels which do not move, and wire, braid or metal straps can be used to bridge panels which do. While there are problems associated with attaching dissimilar metals, I believe that the expected life of the automobile is usually short enough that this is not an issue. I try to keep any connections away from severe weather and corrosives such as salt.

Speaking of signals and noise—I find it helpful to remember this when listening to the radio. I adjust the RF gain so that when tuned to a frequency with no signal I hear little or nothing. I then use the AF gain to adjust the audio level. While I may lose some volume, this can be more than made up for by using an external speaker aimed at the operator rather than the built-in speaker aimed down at the floor or up under the dashboard.

I really enjoy talking with a DX station while driving alone up and down the interstate. Sometimes I can work a fellow mobile station at the other end of the country, which can be quite satisfying. If you're thinking about adding this aspect of the hobby to your palette, I hope that this column will help you decide to join the group—and that these ideas will be of help. Drop me a line to let me know how your experiences are working out, and what suggestions or experiences you've had.

Told-you-so department

During the recent fires in Florida, hams in the Brevard, Flagler and Volusia County areas were quite busy for extended periods. Good job, everyone. While you were busy, you might have missed television reporters asking people to not use their cellular or standard telephones. Seems there was so much telephone activity that not only was the cellular system not working properly, but even the landline system was overloaded. Those emergency personnel who were relying on cellular did not get the results they expected. In the meantime, what I heard on two meters indicated that the hams held things together. Even in this day of high technology, we hams fill a need that can't quite be covered by other options.

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

Last month I talked about the NorCal 38 Special. This month, we'll take a closer look at this rig.

The one that I have sitting on my workbench is rather dead. There's not much audio and no receive at all. The transmitter is *kaput* as well. To make matters worse, if that's possible, I did not assemble the kit. So, to begin the troubleshooting, I had to basically rebuild the kit one step at a time. This did not mean I had to resolder every joint, but rather that I had to follow the instructions step by step to ensure that the kit was put together correctly.

I found no misplaced parts or incorrectly installed components. I checked very carefully for missed solder joints and of course the ever present solder bridges. I found none. All in all, the person who assembled this 38 Special did a pretty nice job. Unfortunately, it still didn't work.

Simple tests

In a rig like this, the best place to start is by checking the main power bus. In the NorCal 38 Special, there is one main voltage regulator. It's a standard 78XX series regulator. Checking its operation is simple. There should be 12 volts on the input and eight volts on the output. A quick check with the calibrated fingertip should tell you if the regulator is pulling too much current. It should be warm to the touch, but not hot enough to leave a layer of skin on the metal tab!

After you have verified that the regulator is working, check each Vcc pin for the correct voltage. On the NE602s, Vcc is found on pin 8. You'll find Vcc on pin 14 of the CD4066 and on pin 8 for the NE5532. You'll need to probe pin 20 on the 74HC240 to check Vcc. While you're at it, check each Gnd pin. These all should in fact be grounded, but if you find a pin that has some voltage floating on it, suspect a missed solder connection or a solder connection with a resin bead in the middle.

Since the 38 Special uses a variable voltage to warp the frequency of a crystal, check to see if the voltage is actually there. In the 38 Special, probe the junction of R4 and L1. As you move the tuning control through its range, the voltage at this junction should move. Voltage tests are the foremost line of tracking down trouble in the 38 Special. Paul NA5N has provided a voltage chart which I am happy to share with you here (**Table 1**). Paul's help came in quite handy while I was looking for the problem in this 38 Special.

Diagnostic voltage measurements for the 38 Special

Voltage measurements are VDC unless otherwise indicated, using a DVM or voltmeter in both receive and transmit modes. Due to variations in voltmeters and Vcc, voltages shown are ±0.25 V. The 38 Special measured has a five-watt amplifier, but *no* RIT or keyer mod. For transmit voltages, make sure you are connected to a dummy load.

AC voltages

Most of the AC voltages in the 38S are too small to register on a DVM/voltmeter, except as follows: HC240 RF output at U4-12,14,16 = 0.14 VAC on transmit (approx.). On a scope, however, you should see about a 7–8 Vpp signal on both the input and output pins of the HC240 PA stage drivers.

The NE5532 audio output at U5-1 registers at about 0.05 VAC on Xmit and about 0.03 VAC on Rcv with a moderately strong signal. This is a 50–150 mVpp signal on a scope.

This chart has appeared on the QRPL reflector and in the NorCal publications. If you E-mail me, I'll send you an electronic copy that prints out quite nicely. My E-mail address is at the top of the column.

Problem found, somewhat

My patient had all the correct DC voltages. It was when I checked the RF voltages that things seemed to be way out of whack. I discovered that if you threw in a whopper of a signal, you could hear it in the headphone. And if the band was really up, you could every now and then make out a signal. I decided the problem must be in the front end. Something must be shorting the signal to ground, or the input transformer was not wound correctly.

So I rewound the input transformer, T1, several times, with no improvement. I also checked for proper placement of D1, D2 and C2 and C4. All seemed to be correct. At that time, I E-mailed Paul my observations. He suggested I scope out pin 7 of U1. That's the receive mixer. With scope probe in hand, I observed that the output of pin 7 was in no way close to the 1.2 Vpp that was supposed to be there. I had only millivolts instead of volts. I suspected a bad NE602, and a new one was installed. That did not fix the problem. By using a counter, I knew that the crystal was on frequency, and I could move the frequency

U1 NE602 RCV Mixer			U2 CD4066 Switch			U4 HC240 Drivers, PA and Sidetone Osc			Diodes (A = Anode: K = Cathode/Banded End)		
	RCV	XMIT		RCV	XMIT		RCV	XMIT			XMIT
U1-1	1.4	1.7	U2-1	7.8	7.8	U4-1	5.7	0		RCV	300mW	5W
U1-2	1.4	2.2	U2-2	7.8	0	U4-2	0	4.2	D1-A	4.8	7.6	8.1
U1-3	0	0	U2-3	7.8	0	U4-3	0	4.0	D1-K	5.4	7.8	7.4
U1-4	6.7	4.7	U2-4	0	0	U4-4	0	4.3	D2-A	4.6	7.6	8.1
U1.5	6.7	4.7	U2-5	0	7.6	U4-5	7.8	3.8	D2-K	5.4	7.8	7.3
U1-6	7.4	7.4	U2-6	0	7.6	U4-6	0	4.4	D4-A	5.7	0	0
U1-7	6.6	6.5	U2-7	0	0	U4-7	0	7.6	D4-K	5.7	0	0
U1-8	7.8	7.8	U2-8	0	6.6	U4-8	0	4.4	D5-A	5.7	0	0
U3 NE602 TX Mixer/ Prod Detector			U2-9	6.6	6.6	U4-9	0	4.4	D5-K	5.7	0	0
			U2-10	6.6	6.6	U4-10	0	0			XMIT	
	RCV	XMIT	U2-11	6.6	6.6	U4-11	7.8	3.5		RCV	Either Power	
U3-1	1.4	1.4	U2-12	5.6	0	U4-12	0	3.6	D6-A	6.1	0.5	
U3-2	1.4	1.4	U2-13	5.6	0	U4-13	5.7	0	D6-K	5.8	0.1	
U3-3	0	0	U2-14	7.8	7.8	U4-14	0	3.6	D7-A	0.6	1.5	
U3-4	6.7	6.7	U5 NE5532 Audio Filter/Amp			U4-15	0.6	3.6	D7-K	0.1	7.6	
U3-5	6.7	6.7				U4-16	0	3.6	D8-A	0.6	4.0	
U3-6	7.7	7.7		RCV	XMIT	U4-17	7.8	3.8	D8-K	0.1	7.7	
U3-7	7.0	7.0	U5-1	3.9	3.9	U4-18	0	3.6				
U3-8	7.8	7.8	U5-2	3.9	3.9	U4-19	0	0				
Q1 2N3904 RF Driver & Bi-phase Franistan			U5-3	3.9	3.9	U4-20	7.8	7.8				
			U5-4	0	0							
	RCV	XMIT	U5-6	3.9	3.9		D3-A: 0-8V, depending on setting of TUNE pot					
Q1-E	0	0.9	U5-6	3.9	3.9		D3-K: 0V (ground)					
Q1-B	0.6	1.5	U5-7	3.9	3.9							
Q1-C	7.6	3.5	U5-8	7.8	7.8							

***Table 1.** Diagnostic voltage measurements for the 38 Special. Note: U1-3 = U1, pin 3.*

Number 45 on your Feedback card

The Digital Port

Jack Heller KB7NO
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]
Compuserve [72130,1352]

This month's column varies a bit from the norm, as it is written while traveling across the USA. We are in the middle of a trip to visit family, mostly offspring, who are scattered from one end of the country to the other. This gives several opportunities to observe the activities of other hams as well as to master the away-from-home E-mail dilemma. The latter part consumed more time than I like to admit.

Another E-mail challenge

Due to the extended time (more than three weeks) on the road, it was necessary to find a way to access my E-mail away from the local phone number provided by my Internet Service Provider (ISP). This was a nearly-traumatic experience that, for a time, appeared unmanageable—so I thought some of you could benefit from my experience.

The ISP I use covers a relatively small area, so I contacted them for help. I considered calling in with the AT&T card, which runs 30 cents a minute when away from the home phone, and felt that wouldn't hurt too badly if I used a little discretion. They informed me they had numbers I could use in about 900 cities across the country for an additional monthly fee. Also, they were contemplating a toll-free number charged by the minutes of access. Lots of options.

When I got to a small city in Idaho, I experimented with the calling card. Using the Windows95™ dial-up accessory and following the seemingly straightforward instructions didn't work (systems normal). I attempted to use the calling card to make a voice call to the ISP, and experienced another complication.

The complexity of the keypad entries when using the card involved 34 digits, but the audible tones, when pressing the keys, disappeared at about 30 digits. After calling AT&T, plus the local phone system, and being assured neither of their systems had such a limitation, it was time to press a little logic into the equation.

The helpful voice at AT&T had explained that some pay phones had this limitation. This meant to me that the problem was likely in the phone set I was using. Another phone on the same line worked perfectly when using the offending dialing sequence. The conclusion? Probably the redial function on the first phone would only hold a certain number of characters. This has probably happened to others who read this column, but it was a revelation to me about the not-so-well-known shortcomings of modern appliances. The technician at the local phone company considered this idea for a few moments and said he felt I was on to something.

The next problem emerged when I got the real skinny on using the calling card with Windows95's dial-up system. The suggestion (instructions) from the senior technician at my ISP was to enter all the numbers in the "number to be dialed" space in the dialer, and separate them with commas, to achieve the proper wait time between sequences. The number of commas was to be determined by experimentation.

I love a challenge; that is part of why I am a ham. After entering the vast array of numbers, with an initial guess at commas, and clicking enter, it actually dialed the number and made the connection! However, that was apparently some strange quirk of fate that I would never repeat. Subsequent dialings and comma-adjustments seemed to result in a problem similar to that which occurred when I dialed the phone card sequence. Hmmm ...

Luckily, the day was saved when the sales rep from the ISP called and gave me their new toll-free 888 number to call (which I am to understand costs less than half what the calling card would cost). The tech rep had assured me the 888 number was not in service as yet, but then what would the tech department know? I'll take what works. It connects like a champ.

You would think all the problems would be behind us, but wait, there's more. We were traveling in our roll-your-own van conversion (another story), staying in RV parks. Not many RV park owners are attuned to the idea that their guests may have need for E-mail access. Generally, the parks priced at the top end of the scale are accommodating; but there are many park owners who still consider E-mail and Internet to be voodoo and, therefore, to be avoided.

If my powers of observation, being tilted by experience, serve me correctly, I will make a prediction. The cost and stability of using a cell phone for these purposes will come into line one day. That simple prediction is based on such things as the years-past phenomenon of the microwave oven that could not be produced and marketed for

---

around via the tuning control, so the VXO seemed to be working. There's just nothing coming out of the mixer. No mixer, no receiver, and no transmit.

I worked on and off with this problem for a week or so at a time. I'd dig in the rig and then put it away to let me work on the problem in my head. I decided that the problem must be a zapped crystal, so I ordered a new one from Mouser Electronics and installed it. Much to my dismay, the new crystal did not correct the problem.

Digging deeper

It occurred to me that if the output of the first mixer were so low, perhaps the output itself was being loaded down. The output of the first mixer is routed to an analog switch, a CD4066, and then passed through to the product detector/TX mixer. I had a CD4066 lying about, so I installed a new one at U2's location. I also replaced the coupling capacitor, C11. Neither fixed the problem of low first mixer output. I went so far as to replace C8, thinking if it were leaky, the output would be pulled to ground. Again, the problem remained and I still did not have enough output from the first mixer.

Strange things were happening

I began to notice that every time I hooked up the scope to the output of the mixer, I had a signal. It just looked awful! I then noticed that by moving my finger near the three wires going to the main tuning control, the output would change. Not slightly, but by a wide margin. It moved so much, you could see a frequency change if you coupled the output to a counter.

And this is where we have to stop. Out of space again. As I work on this column, I am still working on the 38 Special. No, I haven't got it working, but I have learned a lot about the little rig. Right now, I can't say for sure if there will be a happy ending—but you'll never know unless you tune in again next month!

under $500 (decreed by those in the know at the time) or the current example of the laptop with CD drive and color monitor on which I am typing ever becoming an affordable reality. Or ... how about some of the ham gear available these days that is such a bargain when compared to the commercial versions?

User demand and simple competition makes many things possible. The magic arts of marketing answer the needs of the sales department until no longer necessary; then another trend develops that cuts prices to the bone and the manufacturer continues to pay the same dividends to the shareholders. Some part of that activity is quicker than the eye. Anyway, watch the cost of using cell phones in the next few years. You heard it here first.

The elusive chip

Several times in the past I mentioned the shortage of the TCM-3105 chip needed to build a clone for the BayCom 1200b modem. A word from Gene WB2NVI brings news that JDR Microdevices has a supply and that Gene recently purchased two of the elusive little chips at $11.99 each. Although I am currently far from my notes, JDR has a familiar ring. I believe it is mentioned in the LDG Electronics literature as a source. Their Web address is [www.jdr.com]. LDG is the manufacturer of the BayCom clone I mentioned in the July column and their URL is [www.ldgelectronics.com].

Mobile laptop power

One of the modern wonders of the world is the convenience of the laptop to keep us from being tied down to the desktop. The mobility is wonderful, but there is a problem that is difficult to address without throwing large wads of money at it. The useful charge of the battery seems to wane about 20 minutes after the word processor or other program of the minute is in place. The high-buck cure for this is lots of batteries and a fancy desktop charger. If you charge enough batteries to fill a wheeled carry-on bag, you can work with your laptop 'til you drop.

I am not sure where being practical overlaps being poverty-stricken, but those two phrases come to mind when I am operating away from a wall outlet. The wall outlet is where the power supply/charger plugs in for anything but the quickest on-off operations of this portable little computer.

My cure for this has been in place and working for over a year now and that is a wall outlet in the van with a Radio Shack™ 300 watt inverter semi-permanently wired in to the auxiliary battery system. At this moment, I am writing with this lash-up and it is a dependable solution.

Even when parked for an extended period, the deep cycle RV battery provides adequate voltage to operate the computer and other accessories. The battery is rigged to charge from the vehicle alternator and is easily disconnected from the parallel connection to the vehicle battery by a manually switched solenoid.

The RV folks recommend a slight variation in circuitry so the auxiliary battery is charged any time the engine runs. I chose the manual switch so the engine can be started in the event of failure of the regular battery. It paid off last winter when the regular battery died in the cold weather. Just a flip of the switch, and the auxiliary battery provides the juice to the starter with its own set of full-sized cables. However, the system does require thinking. I have to remember to flip that switch at the appropriate times.

After this system was in place, I became aware of an adapter made specifically for the IBM™ laptop that plugs into a cigarette lighter. It sells for about $90 and is distributed by an outfit just up the road from me in Reno. I don't have one of their fliers with me so I will not attempt to mislead you with the wrong name, but will gladly furnish it if you want to contact me.

The inverter solution is good for other purposes. I recharge my razor, power an electric tooth cleaner, and run a printer as well as other homey conveniences while away from home. Too bad I will have to break down and carry a generator for some of the more important things one of these days, such as an air conditioner or the wife's hair dryer.

I am carrying the LDG packet modem with me on the trip. It is only a minor difficulty to find a local ham packet PBBS in an unfamiliar setting. I usually manually dial around 145.100 and listen for audible packet bursts. The "proper" method would be to set the receiver to scan a segment of the band most generally populated by PBBSs and watch for action.

Whatever method I use to find the frequency, it is then necessary to watch for an identification string from the node or pick up on the callsign by observing connections in progress. From that point it is a simple process to log on to the system. You will sometimes be surprised to learn different PBBS software comes in a variation of formats, yet will all offer similar functions. If they did not, we could not expect the entire system to pass information as well as it does throughout the world.

Next month

I didn't bring the Web address chart template with me, so the ever-growing chart will not be in the column until next month. That is the best way to preserve accuracy. Since I began using the copy-and-paste method for the chart, I can't recall a complaint, so I don't want to stir the waters.

Next month, I will endeavor to bring you the results of a new project, but I have learned not to commit to some of the stuff that just doesn't work out. It is too easy to make a challenge into a disaster by simply setting a deadline.

If you have questions or comments about this column, E-mail me at either of the addresses at the top. I will gladly share what I know or find a resource for you. On packet, my current PBBS address is shutting down. If your packet mail comes back or is not answered, that is the reason. I am searching for a new address. For now, 73, Jack KB7NO.

Meeting Your Match

The fine points of understanding matching networks.

Parker R. Cope W2GOM/7
8040 E. Tranquil Blvd.
Prescott Valley AZ 86314

When we connect a load to a source, be it an antenna or an amplifier stage, we expect power to be delivered to the load. Whether the power delivered is the maximum available from the generator (source) or not depends on the resistance of the load relative to the internal resistance of the generator.

The maximum power is delivered to a conjugate matched load. A conjugate matched load has the same magnitude as the generator's internal impedance, but with the opposite phase angle. The reactive component of the load is then in resonance with the reactance of the generator. When the load impedance has the same magnitude and phase angle as the generator, the load is said to be matched on an image impedance basis. The term "image" arises from the fact that impedances on the two sides of the output terminals are images of each other. Only when the load and generator are purely resistive are the image match and the conjugate match the same.

In a voltage amplifier, say in a receiver IF, voltage is the important concern, not power. Therefore, the amplifier load impedance is maximized at the expense of power output. Under these conditions, matching is not important. However, in a transmitter amplifier chain, power usually is critical and the amplifiers matched for maximum power output.

It's all well and good to say the maximum available power from a generator is obtained when the load is a conjugate match to the generator. If you designed the amplifier, you know what the impedance should be, but what is the output impedance of an unknown generator? The internal impedance of a generator can be found with a couple of measurements and some calculation. **Fig. 1** shows a generator with an unknown impedance. R_g is the generator's open circuit voltage divided by the short circuit current, that is, $R_g = E_g/I_g$. When the generator cannot be safely operated unloaded or shorted, the internal resistance can be calculated by noting the voltage across two different values of load. The reactance, either inductive or capacitive, is tuned out when the voltage across an arbitrary load is maximum. The voltage across the load is measured, the load is changed, and the voltage across the second load resistance is measured. The two different loads and load voltages produce two equations with two unknowns, E_g and R_g, which can be solved simultaneously.

For example, if the voltage across a 400 Ω load is 30 V and the voltage across a 200 Ω load is 20 V, the two equations for E_g are:

$$E_g = \frac{(E_{L1} + E_{L1}R_g)}{R_{L1}}$$

$$= \frac{(E_{L2} + E_{L2}R_g)}{R_{L2}}$$

Solving for R_g produces:

$$R_g = \frac{R_{L1}R_{L2}(E_{L1} - E_{L2})}{(E_{L1}R_{L2} - E_{L2}R_{L1})}$$

For the values of the loads and load voltages in the example, $R_g = 400\ \Omega$ and $E_g = 60$ V.

Continued on page 50

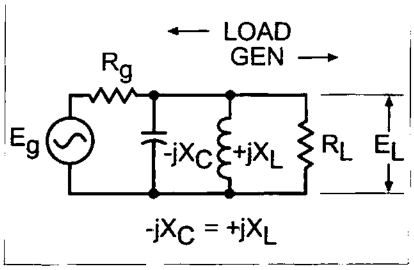
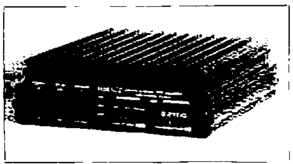


Fig. 1. The generator impedance can be calculated when the generator's reactance is "tuned out."

NEW PRODUCTS



Pick Your Own

This new MIRAGE B-510-G abounds with features you won't find in an ordinary amplifier—you choose the amount of power you need (or want): it's front-panel adjustable from five to 100 watts: and you'll know when you've reached your desired power level because you'll see the LED readout on the PowerGraph™ indicator.

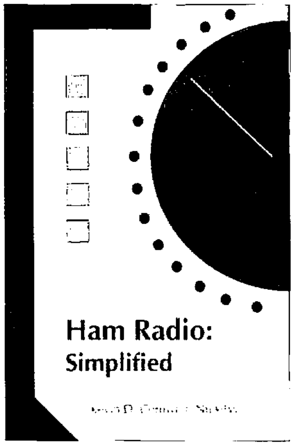
Use a two-meter HT or mobile transceiver in any mode, FM, SSB, or CW. The 5- to 15-dB GaAsFET preamp helps you dig out really weak stations, and reducing intermod is a snap with the 15 dB attenuator.

The MIRAGE B-510-G comes with a free mobile mounting bracket and PL-259-to-BNC patch cable. Priced at $224.95, it's a sleek, quiet, compact, professional-grade two-meter amplifier, and of course it's covered by MIRAGE's one-year warranty.

See your dealer or call (800) 647-1800; FAX (601) 323-6551: or check out the Web site at [http://www.mirageamp.com].

Nye Still With Us

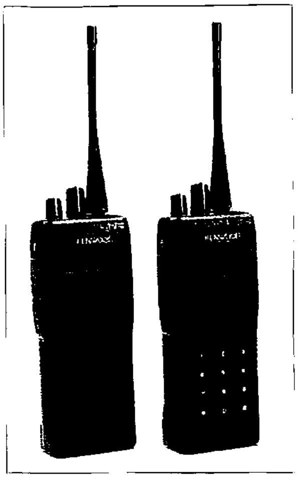
The Wm. M. Nye Company has released its first new product since the late 1970s. It's the Model 330C Key, a superb version of Nye's classic Master Key. The 330C has a chrome base, nickel-plated hardware, and navy knob. Gold-plated hard silver contacts, electrically isolated from the rest of the key, are a luxe touch—it's not surprising the first (single-digit serial numbers) were snapped right up by collectors. The hardware is hand-selected and each 330C is scrutinized for a flawless finish before it's shipped. Each 330C is priced at $139.95 and is covered by Nye's two-year warranty, and these attention-getting keys can be ordered from Morse Express by calling (800) 238-8205. You can also use the secure order page at the Morse Express Web site: [http://www.MorseX.com].



Ham Radio: Simplified

This new illustrated 90-page book by Kevin Cornwell N6ABW provides an excellent entry to ham radio. It explains all the fundamentals of the hobby in simple language. It discusses what equipment to get: how to use it: which bands are good for what: the different kinds of antennas: how to operate without seeming like a dweeb: and how to run RTTY, slow scan, packet, and so on. This is a great book to give to anyone who has made the mistake of showing an interest in the hobby. It'll help set the hook. It's $8.95 plus the usual $1.95 s&h from PhotograFix, 2139 Hilt Road, Hornbrook CA 96044; phone (800) 934-9368 or FAX (530) 475-0916.

We Haven't Seen the Last of *El Niño* ...



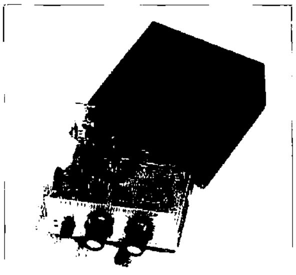
So you should be prepared for nasty winter conditions this year, too. A good way to get ready is to glom onto one of these babies from Kenwood. The TK-290 VHF (150–174 MHz) and TK-390 UHF (450–490 MHz) transceivers provide reliable two-way communications for utility, police, fire and emergency service personnel. OK, they're not for ham bands—but you might find yourself aiding in an emergency or rescue scenario and find the 160-channel capacity and sheer toughness of the weatherproofing to be essential—and it never hurts to have a Plan B.

Simple, Low-Cost Electronics Projects

You say you'd like to build some simple electronics projects? Well, Fred Blechman K6UGT has a new book with 22 of 'em. You've been seeing Fred's projects in *73* for years, so you know how simple he makes it to build stuff. In this book he's got circuits for a talking alarm clock, a variable frequency audio oscillator, a photoelectric counter, several great telephone circuits, and so on. Better than 200 pages for $19.95. If you're short of parts, kits can be ordered for many of the projects. Order from LLH Technology Publishing, 3578 Old Rail Road, Eagle Rock VA 24085; call (800) 247-6553. You can learn more about electronics by doing than just reading.

Cushcraft Web Site

Recently, Cushcraft Corporation introduced an Internet-based tech support program called "TechExpress" to provide customers worldwide with answers to their technical questions and related antenna problems. TechExpress can be accessed from Cushcraft's Web site at [www.cushcraft.com] 24 hours a day, seven days a week. Check it out.



More Than 30 Kits

VECTRONICS now offers more than 30 kits in their line of high-quality electronic hobby kits. From shortwave converters to aircraft receivers, ham radio kits to old-fashioned crystal radios, you'll find just the right project for those wintery weekends/nights ahead. Brighten your winter with one (or more) of these high-quality, detailed kits. Build it with a family member or friend or a curious kid, and get someone else interested in amateur radio!

To order, or for your nearest dealer, call (800) 363-2922: FAX (601) 323-6551; or look it up on the Web at [http://www.vectronics.com].

Meeting Your Match

continued from page 47

The relationship between load impedance, generator impedance, output voltage, and output power is shown in "Impedance and Power." As seen in **Table 1**, the maximum power is delivered to the load when $R_L = R_g$ and maximum voltage across the load occurs when the load impedance is maximum. To realize the desired load resistance requires an impedance transformer.

Transforming the load impedance can be accomplished with wound transformers or with suitable reactive networks. At low frequencies, the reactances required are not practical, and the shortcomings of wound transformers must be accepted. At RF, reactive matching networks are the norm. The impedance transformation of a wound transformer is fixed and determined by its construction—primarily the turns ratio. Therefore, wound transformers just transform the magnitude of the load impedance and seldom provide an image match or conjugate match.

The power output of a transformer or reactive network ideally is equal to the input power. Actually, the output power is a little less than the input power because of losses in the resistance of the windings and core losses. The equations for matching networks which follow assume lossless inductors and capacitors.

Matching networks made with discrete reactive components in the form of an "L", "π", or "T", or their combinations, are commonly used at RF. An "L" network is a "π" or "T" with one element reduced to zero or infinity. **Fig. 2a** shows a generic "π" network that matches the load R_o to the generator R_I. Usually the series arms and shunt arms have opposite signs. When the reactance Z_b in the "π" of **Fig. 2a** is infinite, the resulting network is an "L" as shown in **Fig. 2b**. **Fig. 2c** shows a "T" network. When the reactance Z_a in the "T" is zero, the resulting network is also an "L" as shown in **Fig. 2d**. Both the transformation ratio and phase shift through the network can both be selected in either a "π" or "T". In the "L", the phase shift is determined by the load resistance R_o and the series arm. The phase shift ß through the "L" is $\tan^{-1}(Z_c/R_o)$, the angle whose tangent is Z_c/R_o.

The equations for the lossless reactances in an image matching "L" network are:

$$Z_1 = R_1\sqrt{[R_o/(R_1 - R_o)]}$$

(input shunt arm)
[Equation 1]

and

$$Z_2 = \sqrt{[R_o(R_1 - R_o)]}$$

(series arm)
[Equation 2]

The generator can feed either R_I or R_o, but R_o must be less than R_I.

In most impedance matching applications phase shift through the network is not important and the "L" network is satisfactory. But where phase shift is important, a full "π" or "T" may be required. The design equations for the "π" are:

$$Z_a = \frac{jR_1R_2\text{Sin}\beta}{[R_2\text{Cos}\beta - \sqrt{(R_1R_2)}]}$$

$$Z_b = \frac{jR_1R_2\text{Sin}\beta}{[R_1\text{Cos}\beta - \sqrt{(R_1R_2)}]}$$

$$Z_c = j\text{Sin}\beta\sqrt{(R_1R_2)}$$

where ß is the phase shift through the network. When ß is 90°, Sinß = 1 and Cosß = 0, and the equations for the low-pass configuration reduce to

$$Z_a = -j\sqrt{(R_1R_2)}$$

$$Z_b = -j\sqrt{(R_1R_2)}$$

and

$$Z_c = j\sqrt{(R_1R_2)}.$$

The network behaves like a quarter-wave transmission line transformer.

The design equations for the "T" are:

$$Z_a = \frac{-j[R_1\text{Cos}\beta - \sqrt{(R_1R_2)}]}{\text{Sin}\beta}$$

$$Z_b = \frac{-j[R_2\text{Cos}\beta - \sqrt{(R_1R_2)}]}{\text{Sin}\beta}$$

$$Z_c = \frac{j\sqrt{(R_1R_2)}}{\text{Sin}\beta}$$

where ß is the phase shift through the network.

When ß is 90°, Cosß = 0, and Sinß = 1, the equations reduce to:

$$Z_a = -j\sqrt{(R_1R_2)}$$

$$Z_b = -j\sqrt{(R_1R_2)}$$

and

$$Z_c = +j\sqrt{(R_1R_2)}.$$

Again, the network behaves as a quarter-wave transmission line.

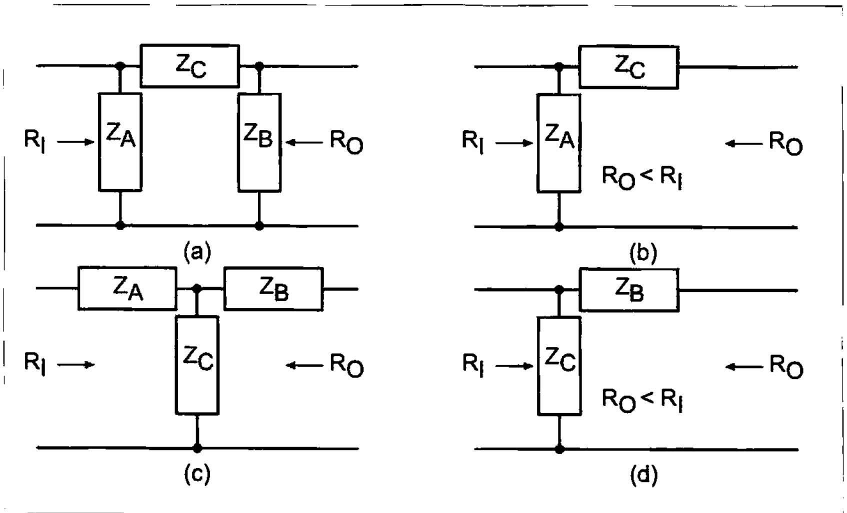


Fig. 2. There are many forms of matching networks. (a) A "π" network. (b) An "L" network derived from the "π." (c) A "T" network. (d) An "L" derived from the "T."

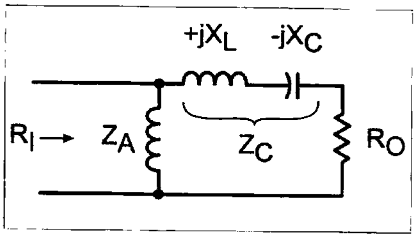


***Fig. 3.** A tuned circuit increases selectivity.*

For an "L" to produce a resistance when looking into Z_a requires Z_a and Z_c to have opposite signs. Most often Z_c is a capacitor and Z_a an inductor, so that DC is blocked from the load and Z_a provides a series DC feedpath for the generator (plate or collector of an amplifier). Unfortunately, when Z_c is a capacitor, the "L" is a high-pass filter and there is no attenuation of harmonics. If harmonics must be suppressed, Z_c can be a series-tuned circuit operated off-resonance to provide the appropriate total reactance for Z_c.

The 3 dB bandwidth of a tuned circuit can be expressed as:

$$BW_{3dB} = \frac{F_o}{Q}$$

where

F_o = center frequency

and

$$Q = \frac{X_L}{R} = \frac{1}{2\pi F_o C R_o}.$$

Making Z_c a series-tuned LC circuit as shown in **Fig. 3** can produce a narrow bandpass response and suppress harmonics. The net value for Z_c is $jX_L - jX_c$. The voltage across capacitor is equal to the current in the load times $-jX_c$. The current in the load I_L is

$$\sqrt{\frac{P_o}{R_o}}.$$

Even with moderate power, the voltage across X_c can be surprisingly high.

For example, when you desire to transform 50 Ω to 800 Ω with a high pass "L", equations 1 and 2 show a series arm Z_c of -j194 and a shunt input arm of +j207. When you want to reduce the second harmonic, a series-tuned circuit operating below its resonant frequency has a capacitive reactance which can replace Z_c.

The response of a single tuned circuit falls 6 dB for every doubling of bandwidth. To achieve about 20 dB of harmonic suppression requires a Q slightly greater than 10. The reactance X_L then must be about j500 and the reactance X_c must be -j694 to produce the net reactance of -j194 required for the impedance transformation. When the power output is 200 W into 50 Ω, the current in the load and the series arm of the "L" is 2 A_{rms} or 2.828 A_{pk} while the voltage across the capacitor is 1.96 kV.

The network equations given in equations 1 and 2 produce a resistive input impedance, but a conjugate match will probably require an additional reactive component to tune out the generator's reactance. When the generator output has a capacitor to ground, a conjugate match requires an inductance in parallel to resonate the generator's capacitance. That additional inductance can be incorporated into Z_a.

For example, when the value of Z_a needed is j207 and the generator has a shunt capacity whose reactance is -j1000, the generator must be paralleled with +j1000 to tune out the generator's reactance. For +j1000 in parallel with $+jZ_a$ to be +j207 requires jZ_a to be +j261.

The "L" network is the simplest circuit for matching a load to a generator, and when the generator is a tube or transistor, the "L" can also provide DC

Continued on page 52

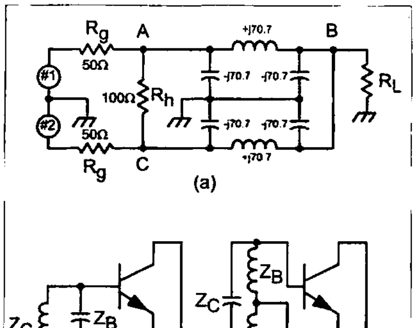


***Fig. 4.** Phase shift and impedance transformation are important in (a) a Wilkenson hybrid; (b) a Colpitts oscillator; and (c) a Hartley oscillator.*

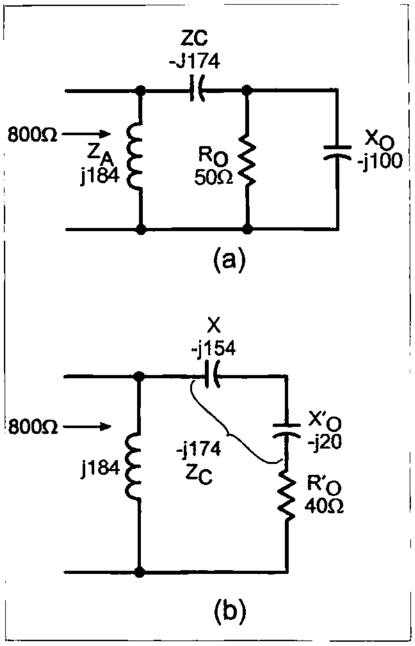


Fig. 5. An "L" can match reactive loads. (a) A load with a shunting capacitor. (b) The equivalent series circuit.

Meeting Your Match

continued from page 51

blocking to the load and a DC feedpath to the amplifier.

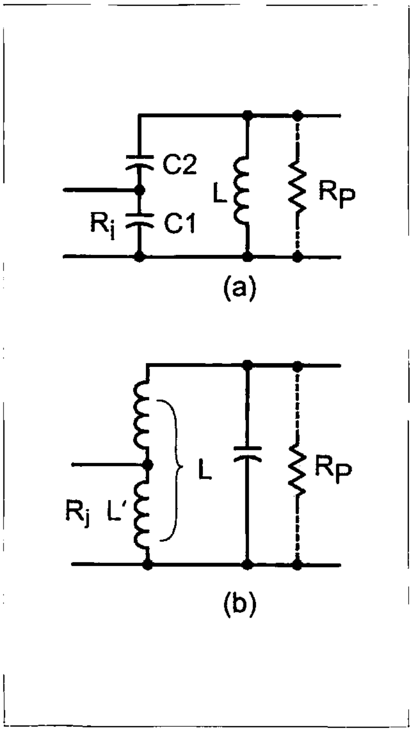


Fig. 6. (a) Tapped capacitors transform resistances. (b) Tapped inductors or an autotransformer can transform resistances.

The "π" matching network shown in **Fig. 2a** is commonly found as the plate or collector load of an amplifier. Z_b is often called the "loading" capacitor and Z_a the "tuning" capacitor. As in the "L", here the selectivity can be increased by using a series-tuned circuit for Z_c.

Occasionally both the phase shift and impedance transformation are important characteristics of the matching network as in the Wilkenson hybrid shown in **Fig. 4**. Like any hybrid, the Wilkenson combines two inputs into one output and isolates the inputs from each other. Isolation means that input #1 does not appear at input #2 and vice versa. Without isolation, some of the signal #1 at point A will appear at point C and may modulate or pull signal source #2.

The "π" networks transform the 50 Ω source to 100 Ω. The two 100 Ω outputs are paralleled to present a 50 Ω source to the 50 Ω output. The phase shift from point "A" to point "B" is 90°, and from point "B" back to point "C" is another 90° for a total of 180°. Therefore, a non-phase shifted portion of input #1 applied to input #2 through R_b cancels #1's signal coming back from the output. The two output capacitors can be combined into one with a reactance of 35.35.

In passing, the resonator of the Colpitts oscillator can be viewed as a "π" with 180° of phase shift. **Fig. 4b** shows the RF circuit of the Colpitts; the DC circuit is not shown. The input to the "π" is fed from the output of the amplifier and the output of the "π" is shifted 180° to drive the input of the

Impedance and Power

Fig. 7 shows the equivalent circuit of a generator and load. When the load is a resistor R_L, the power dissipated in the load is $I_L^2R_L$ or E_L^2/R_L, where I_L is the current in the load and E_L is the voltage across the load. The generator is matched when R_L equals R_g, and the voltage across a matched load is $E_g/2$. When the load is an impedance Z_L, the voltage across the load is:

$$E_L = \frac{E_g Z_L}{(Z_L + R_g)}$$

but only the real (resistive) part of Z_L dissipates power; the reactive part stores energy, then gives it back. The resistive part of an impedance Z_L is:

$$R = Z_L \cos\theta$$

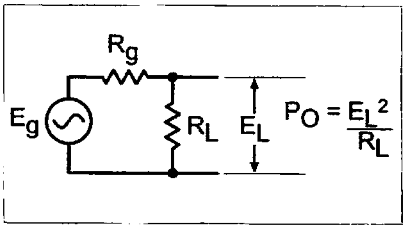


Fig. 7. The power output available from a generator depends on the load resistance compared to the generator.

The relationship of power in the load to the generator's internal resistance is given in **Table 1**. From the values in the table, you can see that maximum power is obtained when the load resistance is equal to the generator resistance.

R_L / R_g	E_L	P_L
6	1.714	0.490
5	1.666	0.555
4	1.60	0.640
3	1.50	0.75
2	1.333	0.888
1	1	1.0
1/2	0.667	0.888
1/3	0.5	0.75
1/4	0.400	0.64
1/5	0.333	0.555
1/6	0.284	0.490

***Table 1.** Relationship of power in the load to the generator's internal resistance.*

amplifier. If the shunt arms of the "π" are inductors and the series arm a capacitor, the oscillator is seen to be the Hartley oscillator shown in **Fig. 4c**.

When the load R_o is in parallel with a capacitive reactance $-jX_o$, as shown in **Fig. 5a**, the equivalent series circuit is shown in **Fig. 5b**. X_o and R_o are transformed to their equivalent series components X_o' and R_o'. 50 Ω in parallel with −j100 is equivalent to 40 Ω in series with −j20.

"Conversions" describes the process of converting parallel and series Rs and jXs to their series equivalents. These calculations are rather time-consuming with a four-function calculator, but tolerable with a "scientific" calculator that has trig functions, squares, and square roots. A calculator that can compute polar and rectangular coordinates makes the calculations a snap.

For example, when $R_o = 50$ and $X_o = -j100$, the equivalent series circuit shown in **Fig. 5b** is $R_o' = 40$ and $X_o' = -j20$. The "L" network that transforms 40 Ω to 800 Ω is found with equations 1 and 2 to have $Z_c = -j174$ and $Z_A = +j184$. Since X_o' will be part of Z_c, the series arm of the network Z_c is:

$$Z_c = -jX_1 - jX_o' = -j174$$

When $-jX_o'$ is −j20, then $-jX_1 = -j154$. The final "L" has $Z_c = -j154$ and $Z_a = +j184$.

Fig. 6a is **Fig. 5** redrawn as the tapped capacitor tuned circuit often used in receivers to match the antenna to the input and reduce the loading on the input circuit. R_i is the input resistance, the antenna resistance, and R_p the transformed output resistance. Near resonance, the effect is to make the impedance offered to the input terminals less in magnitude than the parallel impedance of the entire circuit without changing the character of the impedance curve as far as shape or equivalent Q is concerned. Tapping a parallel resonant circuit accordingly offers a means of adjusting the magnitude of impedance obtained without changing the characteristics of the circuit itself. The ratio of impedance offered by the input R_i to the parallel impedance of the circuit R_p is:

$$\frac{R_i}{R_p} = [\frac{C_1}{(C_1 + C_2)}]^2$$

For example, if R_i is 50 and X_1 is −j5, then their equivalent series values are $R_i' = 0.49$ and $X_i' = j4.9$. If X_2 is −j50, then the total capacitive reactance across L is −j55. The equivalent Q is:

$$Q = \frac{X}{R} = \frac{55}{0.49} \approx 112$$

A tapped inductor follows the same procedure as the tapped capacitor network when there is no mutual coupling between the inductors. But, when there is mutual coupling as shown in **Fig. 6b**, $R_i/R_p = (M_{eq}/L)^2$, where M_{eq} is the total equivalent mutual impedance between L' and the entire coil L, including both common and inductive coupling.

Continued on page 56

Conversions

The impedance of the series circuit shown in **Fig. 8** is the vector sum of a resistance R and a reactance jX. The voltage across a resistor is in phase with the current in it and is shown on the horizontal axis. The voltage across a reactance is 90° out of phase with the current in it and is shown on the vertical axis. In an inductor, the voltage leads the current by 90°, and in a capacitor the voltage lags the current by 90°. The voltage across an inductor is expressed as jX_L, while the voltage across a capacitor is $-jX_c$. The factor j rotates a vector 90° in a counterclockwise direction. **Fig. 9** shows the vector sum of R and +jX. The resistive voltage is on the horizontal axis and the reactive voltage on the vertical axis. Their sum Z is the vector addition of R and +jX. From the Pythagorean theorem,

$$Z = \sqrt{(R^2 + X^2)}$$

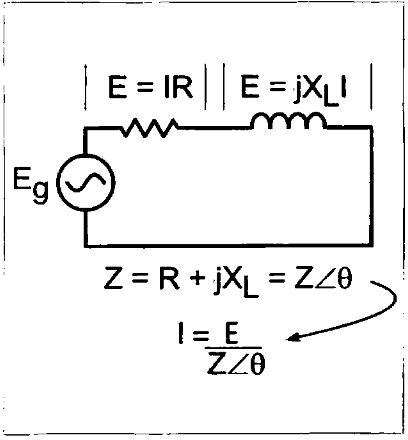


Fig. 8. A resistor and inductor in series add vectorially.

and from trigonometry, the angle θ is the angle whose tangent is X/R ($Tan^{-1}X/R$). Also from trigonometry, $X = ZSin\theta$ and $R = ZCos\theta$.

The horizontal axis represents the real component, resistance R or conductance G (G = 1/R), while the vertical axis represents the imaginary component, the reactance X or susceptance ß (−jß = 1/jX).

$R_1 + jX_1$ can be added to $R_2 + jX_2$. Reals are added to reals and imaginaries added to imaginaries: $(R_1 + R_2) + (jX_1 + jX_2)$. Of course, $R_1 + jX_1$ can be multiplied with $R_2 + jX_2$, but it's much easier to do so in polar form:

$$Z_1\angle\theta(Z_2\angle\phi) = Z_1Z_2\angle(\theta + \phi)$$

Treat the angles as exponents.

Dividing rectangular forms is also much easier in polar form:

$$\frac{Z_1\angle\theta}{Z_2\angle\phi} = (\frac{Z_1}{Z_2})\angle(\theta - \phi)$$

Again, treat the angles as exponents.

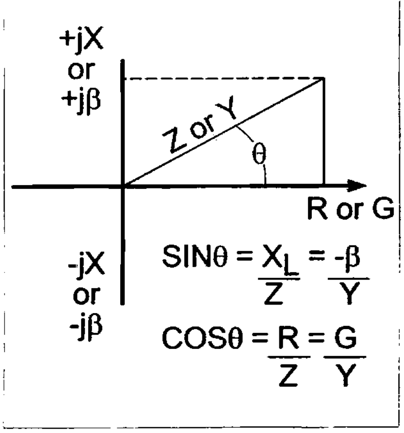


Fig. 9. A circuit containing R and X is depicted as a right triangle.

The Perfect Field Day

Did everybody have fun?

Joseph Molter N8IDA
Cuyahoga County ARES/RACES
Coordinator
3842 Monte Vista
Cleveland Heights OH 44121

Field Day and the SET (Simulated Emergency Test) used to be great times for camaraderie and testing your skills as an emergency communications responder, but unfortunately our two great times in the field have turned more into contests about the number of contacts we can make. A great Field Day was a tent, an old beat-up Coleman® generator to run a rig and a couple of lights, and tossing up a couple of wire antennas into a tree. The real challenges were keeping the generator running, the bugs away, and the local squirrel population from chewing your support ropes. Fortunately, there still are radio operators who enjoy challenging themselves more than worrying about how many stations have been logged on the portable computer.

Planning

For those of you who wish to tackle Field Day, the first thing to do is to pick a site that can accommodate all the people and equipment and the portable antenna farm. You may want to consider a site that can also generate some positive media coverage for amateur radio. Local parks, zoos, lake- or oceanfront areas, or maybe even the odd amusement park.

Make sure that all necessary permissions and signed agreements are in place, even if FD is out on the back 40 of your Uncle Ned's farm. It is best to have stated in writing what is going to be done, what local facilities you will need (e.g., rest rooms, showers, water source), and the time frame you and your group will be there. Make doubly sure that the place is cleaner than when you arrived and any damages are taken care of, no matter how insignificant.

Notify the media with a well-prepared press release and maybe even a few pictures in advance. Remember, while doing all of this preparation, to make sure that you'll be having fun. If FD becomes too much of a chore, you won't enjoy yourself, and you certainly will not be successful, contesting or not.

The next item to consider is the BEL (Basic Equipment List). This is probably the hardest part of Field Day. I remember going on vacations as a kid and coming back with that extra suitcase my mother packed—which I never even opened *once*.

The BEL can be broken down into several sections: amateur radio gear (rigs, antennas, feedlines, accessories); living accommodations (tent, sleeping bag, cooking equipment); personal needs (food, clothing, first aid supplies, hygiene needs); power supply (generator, batteries, solar). Make sure that the list is as complete as possible. Go over it with several amateurs—don't let just one guy do it because he was in the Marine Corps and is supposed to know these things.

It is always important to remember the sunscreen and bug repellent; more outings have been ruined by sunburns and mosquito bites than any of us cares to remember. You might even consider setting up and having a run-through to make sure that everything you need is there. And don't let things get so out of hand that you discover you'll need to rent a truck to move your supplies to Field Day!

Decisions must be made as to the bands and modes you wish to operate. This decision will also affect your selection of gear to take. Plenty of pens, pencils, and logbooks are also needed. Leave the computer at home—log

your contacts the old-fashioned way. Stick with the bands and modes you and your friends or amateur radio group are familiar with. I personally like to log onto homemade sheets for this type of event. Use a pencil—it is easier to correct any errors and can be transposed later onto more formal log sheets. Don't forget a copy of the rules if you wish to score your Field Day for points and competition. (No! I am not against contests!)

Field Day has arrived

The first thing to do on Field Day morning is remind yourself: This is going to be fun, *this is going to be fun* ... sure! Second, pack all those helpful things like toilet paper, bug spray, sunscreen, aspirin, soda pop, lots of coffee, and the ever-popular Oreos®. Now we can worry about the equipment and everything else.

Get things packed and time your arrival to take full advantage of the setup time before the actual event. (The rules for Field Day operation and classes of competition are always published in *QST*.)

During your planning phase, everyone on the team should have been assigned a job. The initial setup should consist of antennas and power systems. These will occupy most of the time. Power sources need to be adjusted for proper voltage and current. If you are using a gas- or wind-powered generator, you also want to make sure that you arc producing the correct frequency (60 Hz at 110 to 120 volts). Antennas should be adjusted to SWR and carefully checked for any possibility of a short during the following 24 hours. Follow the same guidelines for putting up temporary antennas as you would use for a permanent installation. This is especially true around power lines.

The next items on the list are operating facilities and sleeping quarters. Believe it or not, there are always a few people who are determined to get some sleep during Field Day. Keep sleeping quarters (tents) away from the operating facilities. If you plan to have an eating area, this should be set up close to the operating tent. Run any power cables into the tents if necessary. Make sure all cables are properly labeled and flagged, so nobody will accidentally trip over them or be electrocuted.

Finally, the rigs can be set up and testing can commence. Beforehand, all accessories and radio cables should have been labeled for easy installation. Watch for obvious problems, such as intermod and too much load on the generator.

You're finally ready to start Field Day operations. Make sure there are lots of paper and pencils for logging and any note taking. Sometimes an inexpensive cassette recorder is handy to take verbal notes during operations on such things as addresses given over the air, problems that may arise and can be forestalled or avoided next year, and notes on changes or suggestions for improvement. This is also very handy for any debriefing session you may decide

to have immediately following Field Day exercises.

Are we still having fun?

Ready, set, operate! During that actual part of Field Day, make sure all operators work in shifts. Some folks seem to think they can go nonstop—they end up losing their voices after four or five hours. People should work in two-hour shifts, especially on voice. Trade off with the person who is logging other operators. Let people rest their voices.

This is also true for people doing CW. Most of us are fairly casual radio operators and are not ready to run a radio marathon. Hands can cramp up from keys or bugs.

Headphones are a good addition, both for the operator and logger. This helps cut down on background noise and makes logging a lot easier. It is fairly easy to wire up two headphones to a single jack. Some people find it easier to log directly into a computer. Make sure the computer has a good "clean" source of power. Remember, above all: This is not Operation Desert Storm! Have fun and don't make yourself miserable!

During the next 24 hours, make sure that all personnel get plenty of food and water. Some parts of the country can be quite hot in June and heatstroke is a real possibility. Even the best-trained athletes and soldiers can suffer from heat exhaustion and sunstroke.

Make sure that a source of good clean water is available. During hot weather, it is easy for someone to consume eight to 12 liters of water in a 24-hour period. Sports drinks are also a good supplement to water, in that they supply necessary salts, minerals, and carbohydrates. If anyone does exhibit signs of heat exhaustion, get him somewhere cooler and get fluid into him. Watch for signs of shock. It is a good idea to have someone available who has first aid training, and no one should be hesitant about calling for additional help.

Finally, even if people don't want to sleep, make sure that they do get at least some rest away from the operations areas.

Taking it all back home

Once Field Day is over, start packing up and dismantling the camp. Keep notes on those items that were never used or items that you wish you'd had. Carefully relabel cables and accessories. Safely store any fuels and allow the generator to cool down before moving it. Make sure you leave the area that you used for camp cleaner than you found it.

If you are competing in the contest part of Field Day, make sure that all logs are filled out correctly and ready to send in. Have several people review the logs before sending them in.

Arrange to have a debriefing session after Field Day to check any problems or deficiencies. Gather your notes and that tape recorder I mentioned earlier and talk over with the whole crew your present success and possible improvements for next year.

Modify your Basic Equipment List if necessary. What bands didn't work well for your location? Which radio is not very user-friendly during a fast-paced contest or emergency situation? How does your Field Day experience relate to an actual disaster situation with field communications and remote power sources? Do you want to go back to the same area or try someplace different? The month of October is not too soon to start planning for next year. 73

UNITED STATES POSTAL SERVICE™ Statement of Ownership, Management, and Circulation (Required by 39 U.S.C 3685) (1) Publication Title: 73 Amateur Radio Today (2) Publication No. 1052-2522 (3) Filing Date 09-14-98 (4) Issue Frequency. Monthly (5) No of issues Published Annually: 12 (6) Annual Subscription Price $24.97 (7) Complete Mailing Address. 70 Route 202 North, Peterborough, Hillsborough Cty., NH 03458-1107 (8) Complete Address of Headquarters or General Business Office of Publisher (Not Printer) 70 Route 202 North, Peterborough, NH 03458-1107 (9) Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor: Wayne Green, 70 Route 202 North, Peterborough, NH 03458; Wayne Green, 70 Route 202 North, Peterborough, NH 03458, F.I. Marion, 70 Route 202 North, Peterborough, NH 03458 (10) Owner. Shabrotnal Way Ltd., P.O. Box 69, Hancock, NH 03449, Wayne Green, P.O. Box 69, Hancock, NH 03449 (11) Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. None (12) (For completion by nonprofit organizations (13) Publication Name 73 Amateur Radio Today (14) Issue Date for Circulation Date Below: May 1998 (15) Extent and Nature of Circulation. Average No. Copies Each Issue During Preceding 12 Months. Actual No. Copies of Single Issue Published Nearest to Filing Date (a) Total No. Copies (Net Press Run) 52,534; 44,313 (b) Paid and/or requested Circulation - (1) Sales Through Dealers and Carriers, Street Vendors, and Counter Sales (Not Mailed) 8,797; 7,049 (2) Paid or Requested Mail Subscriptions (include Advertisers' Proof Copies/Exchange Copies) 17,498; 16,049 (c) Total Paid and/or Requested Circulation (Sum of 15b(1) and 15b(2) 26,295; 23,098 (d) Free Distribution by Mail (Samples, Complimentary, and Other Free) 312; 312 (e) Free Distribution Outside the Mail (Carriers or Other Means) 0; 0 (f) Total Free Distribution (Sum of 15d and 15e) 312; 312 (g) Total Distribution (Sum of 15c and 15f) 26,607; 23,410 (h) Copies Not Distributed (1) Office Use, Leftovers, Spoiled 123; 229 (2) Return from News Agents 25,804; 20,674 (I) Total (Sum of 15g, 15h(1), and 15h(2)) 52,534; 44,313 Percent Paid and/or Requested Circulation (15c/15g x 100) 98%; 98% (16) This Statement of Ownership will be printed in the October '98 issue of this publication. (17) Signature and Title of Editor, Publisher, Business Manager, or Owner: Wayne Green Date: 09-14-98. I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions *(including fines and imprisonment)* and/or civil sanctions *(including multiple damages and civil penalties)*

G'Day, OM!

continued from page 32

describing our tour—and ham radio in general—appeared in many newspapers, including those in Narrabeen, Port Macquarie, Dunedin, Hastings and Te Awanga. Many included photos.

In one of the many E-mail messages handled for us, Peter Smith ZL1ARB, of Orewa, New Zealand, added to one of my messages, "... and we have enjoyed having them with us—they have all been wonderful ambassadors for America!" And, indeed, we did try to be good ambassadors for both the United States of America and for the wonderful world of amateur radio. 73

Meeting Your Match

continued from page 53

However, if a tapped coil is wound on a ferrite core so that the mutual coupling is high, the two coils behave like an ideal transformer with predictable results (the impedance is transformed by the turns ratio squared). With air-cored coils, the coupling coefficient is small and the ideal transformer approximation does not hold in all cases. However, if $R_p/w_0L \geq 10$, and $R_i \geq w_0L$, the circuit still behaves like an ideal transformer at the resonant frequency. In passing, I should mention that you should be aware that when the turns ratio is large and the secondary is a few at the end of the primary, the coupling may be low, even with a core. To achieve tighter coupling, distribute the secondary over the entire primary; the distributed capacity will increase slightly but the coupling will be much tighter.

Matching networks can be used to match an arbitrary load to an arbitrary generator for maximum power output, maximum voltage, or a particular phase shift. Calculating the values of reactances for a match may seem intimidating, but it will give you a better feel for what the parts do than using nomographs or charts. Matching networks made with discrete reactive elements are flexible and can be adjustable—and that's something wound transformers can't easily offer. 73

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Moderator's note: Roger and Ron Block of PolyPhaser Corporation have put together a well-written series of tips and suggestions on how we can effectively protect our ham radio stations from the effects of a lightning strike. The series began in the January of this year, and Part 9 appeared last month. Here is Part 10, the final installment of "Lightning protection — what your mother never told you!"

Worth repeating

Mother Nature will see to it that nothing we place in the soil will last forever. But we can do our part to design a grounding system that lasts a reasonable period of time. First, always use compatible (similar) metals in your grounding system. If copper is used, don't mix it with tinplated copper wire.

On all mechanical compression joints, copper joint compound should be used to cover the hardware. This will prevent corrosion which can cause a loss of the compression strength and increase joint resistance over time. The joint compound, a petroleum-based product with conductive copper flakes, displaces water, oxygen, acids and salts.

Exothermic connections (when used) should be allowed to cool slowly to prevent stress corrosion. As explained earlier, an exothermic weld is created with a graphite mold for the desired connection, into which copper oxide and aluminum powders are placed. An additional starter powder ignites the exothermic process. The resultant molten copper is deposited into the lower mold cavity where it burns away any oxides and creates a larger fused connection. This larger cross-sectional bond decreases resistance and increases the surface area which reduces the inductance of the joint. Since the materials are similar, the connection lasts as long as the remaining grounding material.

A grounding system should be tested annually. It should also be checked annually for excessive corrosion. Yes, it requires some effort, but anything less is leaving too much to chance (the very thing that we're trying to avoid).

Know your soil's pH. If it's too acidic, either correct it to neutral (using gardener's lime) or your ground system will suffer the consequences of excessive corrosion.

Selecting a protector

Coax protection: Both 50 and 75 ohm protectors are available. Most amateur applications will be for 50 ohms.

Speed: Is the measure of protection for lightning only, or lightning and NEMP (Nuclear Electromagnetic Pulse) threats? Most of the protectors do well for both, but for some critical applications, higher-speed protection may be necessary.

Frequency range: There are broad-coverage units (DC to 1.5 GHz specials) to single-frequency filtered models. Today it's possible to make units to 20 GHz. Most of lightning's energy is concentrated in the lower frequency ranges of DC to 1.0 MHz. The further away from this range, the less the amount of energy that will get through to the equipment (throughput energy). Always choose the lowest throughput energy for the desired frequency range.

Transmit (Xmit), Transceive (Xcv) or *Receive Only (RO):* The number of Xmit signals is important (if ham repeaters are sharing a common antenna). Protectors are voltage sensitive and multi-Xmit signals are voltage additive, not power additive. Two 100 watt Xmit signals combined equal 200 watts of treating power, but the additive voltages have peaks of 200 V, which equate to a single 400 watt signal. Because of this, multichannel, simultaneous Xmit systems must have a higher turn-on voltage and be designed to handle the peak instantaneous RF currents that can normally be reached. These are generally known as "combiner protectors."

Transmit Power: Each model that can support a 10 watt or higher level signal is categorized by its power level capability. Generally speaking, as the frequency is increased, the power handling rating is reduced. This is done for many reasons, the most important of which is to be sure the protector will turn off after a lightning or EMP firing, and not be "kept alive" in a glow state by the presence of the normal transmit energy. The turn-on voltage (as mentioned before) is tied in with power handling. In units that do not support DC continuity, little protection is lost by going to a higher turn-on voltage unit, especially if Xmit combining is planned in the future.

Presence of AC or DC Power With the RF Signals: This is usually relevant for "receive only" situations, such as tower-top-mounted preamps. However, there are special units for the higher UHF range, and into the microwave region, for the higher current requirements of tower-top transmit amplifiers. Units are also available for DC injector/pickoff and for protecting already injected coax lines.

Mounting: Bulkhead panels are recommended. Flange styles may be mounted on a bus bar or on a single-point ground panel. A ground strap larger than the total sum of all the circumferences of the coax shields should be used to connect to a low inductance ground system.

Connector Type and Gender: UHF style connectors are poor at the UHF frequencies (300–3000 MHz). Wattmeters that use these connectors will give misleading readings even when using type-N adapters at the UHF bands. Type-N connectors are recommended even though they have limited center pin lightning current handling capability when compared with UHF connectors. BNC, SMA and F male and female are also commonly found on stock protectors.

Data/Phone Line Protection: For lightning, twisted pair cable bundles will mutually couple surge energy to all other pairs in the cable. Unused pairs should be grounded (if allowed). Protectors are available for use on 66-type punch-down blocks with an appropriate grounding bus. For 6 pairs or fewer, more energy will be present per pair, so a hybrid protector that can handle energy levels that would normally vaporize standard 24 AWG wire pairs should be used. Selection of data/phone line protectors depends on the presence of either -48V battery and/or ringing voltages. The line impedance and total allowable loop resistance (as well as the highest frequency or bit rate), will determine the insertion loss from the protector's I/O line resistance/inductance and capacitance.

Power Line Protection: For lightning and EMP, shunt-type protectors will limit the voltages to a safe level for most non-electronic equipment. Inline-type protectors are mandatory for electronic equipment survival. These inline units should be mounted/grounded close to the equipment being protected. For mainframe computers and high-power RF equipment, inline power mains protectors are produced which provide single or polyphase protection with EMI/RFI filtering. They'll often have

front panel status lights and local/remote alarm contacts as standard equipment.

For power line protector selection, the peak voltage, number of phases, configuration, and inline current usage will pinpoint the unit best suited for a particular application. Voltages to 480 VAC are readily available for single- to three-phase applications. Replacement modules and breakers are usually available separately for most models.

The Big Bertha lightning simulator

Our quest for knowledge has taken us to the point of actually making a lightning simulator that couldn't be purchased. We lovingly call it "Big Bertha." It consists of ten 200 microfarad capacitors, which have a total weight of three quarters of a ton! Not your typical tabletop high-voltage insulation tester! The simulator is set up as a "Marx Generator," which means that the capacitors are charged in parallel and then connected in series for the discharge phase. This is the most straightforward way to get 100,000 volts delivery with 62 kA and 100,000 Joules of energy.

Delivery to what?, you may ask. An antenna, of course.

To start with, we thought that we needed to know more about the effects upon and the output from an antenna when it gets hit by the real thing, lightning. We'd already tested transmission lines and knew how they share strike current with the tower, but we had no idea what effect the different antenna designs would have on the current waveform. Some of the questions that we needed answered were:

1) Would the antenna ring, and if so, for how long?

2) What voltages would it reach?

3) What effect does bandwidth have?

4) How much energy is coupled to a side-mounted antenna when the tower is hit?

5) What are the effects and pickup patterns from nearby strikes?

It's an ongoing project, and we hope to have some results of tests from donated commercial antennas shortly. The aim is to provide commercial antenna manufacturers with real-life survivability data, with the goal in mind of permitting them to build better antennas from a lightning survivability standpoint (and not just an RF transmission one). It would also be advantageous to the industry to have a standardized lightning survivability testing scheme, so that the end customer can factor an antenna's lightning resistance into the purchasing formula. Perhaps the realization of this goal may yet come out of our research.

If funds permit, we will also be working, together with the University of Nevada (and Big Bertha), on testing and learning more about the glassification of ground rods and on arcing in and out of the earth/rock interface. This knowledge will be helpful for developing even better grounding systems for use in poor soil conditions and for rock-encrusted mountaintop sites ... and so the research continues.

We hope that you've enjoyed learning from this series of columns on lightning and its effects on nearby electronic equipment, and that you've gained some valuable information on how you can protect your own home ham station (or repeater station) from lightning-originated damage. From the information this month and in previous columns, you can see that effective lightning protection isn't as simple as just a ground rod and a spark-gap arrestor. For state-of-the-art protection, a well planned and mechanically sound lightning diversion system is essential for maximum survivability of your equipment. We recommend that you go back over the previous columns since the January 1998 issue and refresh your memory from time to time. It can take a while to become adept at thinking in lightning protection terms with regard to everything you do with your antenna and station ground construction and maintenance, but once you do, it can pay very big dividends. Please let us know if you enjoyed the series.

Moderator's note: If you missed any installments of this series by Roger and Ron Block, you can contact PolyPhaser Corporation by telephone at (702) 782-2511, at [http://www.polyphaser.com/] on the Web, or at (702) 782-6728 for access to their telephone BBS. Ask for a reprint of their special bulletin, "Protection to Keep You Communicating." This month's treatment concludes the series by Roger and Ron ... we sincerely thank them for their generosity in the sharing of this hard-won information with us via the pages of 73 Amateur Radio Today. *This concludes the series "Lightning protection — what your mother never told you!"*

Murphy's Corollary: In crisis situations that force us to choose among alternative courses of action, most will lead us on an entirely wrong course!

As we begin the fourth consecutive year of the Ham To Ham column in *73 Magazine*, we offer a very special thanks to this month's contributor:

Roger Block, President
PolyPhaser Corporation
2225 Park Place
P.O. Box 9000
Minden NV 89423-9000

If you're missing any past columns, you can probably find them at *73*'s Ham To Ham column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the moderator at the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

Never Say Die

continued from page 5

Like in the health field. You can spend a fortune reading the endless books and newsletters, 99% of which are a waste of time. So I read 'em all, talk it over with people I've learned to trust, and then make truly dependable information available. Like this, for instance.

If you have a product that people need it won't make any difference, at least for long, if the banking system fails, if the government collapses, or whatever.

My wife Sherry discovered that there was a need for how-to-dance video lessons. She's running a nice business selling them from our farm. She has a whole room full of video duplicators running day and night, a barn full of the packaging, and so on.

So what are you using your living room for, watching TV? Our living room has two computer systems in addition to the TV. The study has a computerized video editing setup, and so on.

Hey, are you still just sitting there? Why are you so stubborn? America really can be the land of the free (except for the freedoms we have gradually ceded to the government), so start untying your bonds.

Skilled Workers

Did you watch the PBS program about the schools in China? China's aim, like ours, is to provide their country with skilled workers, and their schools are leaving ours in the dust. Countries compete with each other by exporting products. And that means either by making products cheaper than competitors can, or better. Or both.

The big money in exports obviously lies in high volume sales, which in turn means they are being made by big companies. It is these big companies which need skilled workers, so it makes sense from an international business viewpoint for a country to train as many skilled workers as possible. Remember, business *is* war today, as I've discussed recently.

Our public schools, as I've also pointed out before, were first started by our church leaders as a way to ensure them a steady supply of compliant churchgoers (and resulting revenues). Then the industrial revolution came along, bringing a need for skilled workers for our factories. Our public schools had the aim of taking a diverse supply of young children and turning them into as nearly identical workers as possible for our giant industries. Workers who would do as they were told without asking questions so as not to stop our production lines.

Well, that's a good competitive strategy for a country, but it means that everyone will have to settle for about the same pay and a similar life style.

I went through that mill, just like you did. And no one ever blew the whistle and said, Hey, wake up, being just one more bee in the hive isn't your only alternative. One more skilled ant worker in the anthill. When WWII came along, I was another warrior ant. I was a skilled worker ant at the General Electric Company, testing radio transmitters. I was a skilled worker ant at Airborne Instrument Laboratories as an engineer.

Then, when I was 28, I finally wised up and started my own company. Since then I've been the editor and publisher of a bunch of high-tech magazines in the ham radio, computer and digital audio fields. I've manufactured audio and computer products, started and run a chain of retail stores, imported and exported high tech products, and so on. But you know, virtually none of the skilled worker education I went through in public school and college has ever been of any use to me.

I watched the Chinese children all doing well in trig and spherical trig. I've never needed any of that. Nor has the torture of "learning" calculus ever paid off for me, despite the wide variety of businesses I've run. Torture is not an exaggeration. I struggled through two years of calculus before I went into the navy in 1942. Then, when I went back to school four years later, I hadn't any memory whatever of the calculus I'd supposedly "learned" before the war — so I had to relearn it all again. I've never needed any of it.

So I'm preaching revolution. The next time you come out of the anthill, take a look around. You really don't have to live like that — in an apartment and commuting to work. What kind of quality of life is that?

Our country may want you to shut up and apply your working skills for a large corporation, but the route to freedom lies outside the anthill or hive. And it also lies outside of the few skills they're forcing you to acquire in our public schools.

Reading and writing are good skills, but as John Taylor Gatto, the prize-winning teacher, has explained, they can be learned by almost anyone in 100 hours. A couple of weeks. Arithmetic and algebra I've also found very useful. I remember learning about poetry along about the third grade, but I don't recall ever being encouraged to write it. A fourth-grade course in the fundamentals of art also has been helpful for me — first as a TV cameraman and director, and then as a magazine editor. But I wish I'd been encouraged to develop my art potential.

They taught me to read music in the third grade, but never to write it. The reading part came in handy when I became a chorister at St. Paul's Church, and then went on to sing in several first rate choruses. But I wish I'd been encouraged to write music.

My Brooklyn public school had a weekly class for the whole school in classical music. That helped get me interested in hi-fi, which led to my first manufacturing company making loudspeaker enclosures. It also helped get me interested in listening to classical music all through my life.

As far as I know, our public schools have stopped all that poetry, art and music nonsense in the lower grades. Hey, how many art museums have you visited? Have you ever tried sculpting, painting, writing poems or music?

Most of the skills needed to be successful with your own business aren't being taught — because that's not in the interest of the big businesses which are pretty much calling the tune. It's their money that gets politicians elected, not yours, and not that of entrepreneurs. It's their money that's controlling Congress.

It's too late for you, but how about your children or grandchildren? Do you want them to be skilled workers or entrepreneurs? Do you want them to be wage slaves or free persons?

Oh, yes, one more thing. These days it takes the work of two wage slaves to maintain an acceptable standard of living, but only one of a free person to do many times better.

FCC Sells Out

The FCC, long a champion of freedom of the airwaves, seems to have been bought and paid for by the cellular telephone industry. I wonder at what level money changed hands? Did the pressure to further curb our freedoms come from our easily-bribed Congress? Or have the FCC commissioners gotten in on the action?

We are losing our freedoms slice by slice while you are too busy watching TV and rag-chewing on the local repeater to be bothered to do anything about it. I'm not normally much one for flag waving, but this is getting my goat. One of the reasons I spent four damned years in the navy fighting WWII on a submarine was supposedly defending our liberty ... our freedom. And now Americans are sitting there on their fat asses, pissing away what millions of us fought for. And a lot died for.

I got a letter from a guy who is in prison. He says the police broke into his house and planted some drugs. Then they confiscated his home, car,

and bank account, and put him in prison. What can he do, he asked. We've been losing our freedoms to the DEA, the FBI, the IRS, and down through the alphabet, nibbled away one at a time. Now we can be arrested and fined for listening to the wrong frequencies on our radios — or even being able to!

So the FCC wants manufacturers to pot any circuits which could be modified to tune in cellular phone channels. In this way the cellular phone companies can tell their customers that their phone conversations will be private and won't be compromised. Of course, anyone really interested in listening to this stuff can use an old scanner or even an old TV tuner.

The hams in the surveillance business tell me that all this is eyewash, that *any* phone conversation can be monitored by someone who knows what he's doing.

Nostalgia

Okay, all you old-timers, time to test your memory. At what time did Amos and Andy come on every night? Which series had "Poor Butterfly" for its theme song? Who said, "Wanna buy a duck?" How about, "Okay, Colonel." What was The Singing Lady's name? Who was Ukelele Ike? Vic and who? Who wrote the radio play *The Loblies*? What was the theme song for Chandu the Magician? Who was the warden at Sing Sing? What was the theme song? And who was Your Host? What product sponsored the Sherlock Holmes program? What product sponsored Orphan Annie? How about Jack Armstrong's sponsor? The Little Theater just off where? Who always said, "And so long until tomorrow?" H.V. who? Floyd who? Myrt and who? Who was Hairbreadth Harry's girlfriend? Who said "Fap"? How about "Gloriosky, Zero"? Remember Joe Bftsplk? Hans and Fritz? What fairy godfather said "Cushlamacree" and used a stogie for a magic wand? Buck Rogers' sponsor? What "hit the spot, 12 full ounces, that's a lot"? How much were 12 Marlin blades? What song had "fooderyackasaki" in it? Who played the bazooka? What was the title of the Popeye cartoon? The Maggie and Jiggs cartoon? Skeezix cartoon? What poisonous food product sponsored The Lone Ranger? How about Singin' Sam? What product did he promote ("no brush, no lather, no rub in")? Whose cabbage patch? What was Buster Brown's dog's name?

There, that ought to hold you old buzzards.

Okay, one more. How many of you turkeys went to Saturday matinees where, for a dime, you got two feature films, a full-length western, two serials, seven cartoons, plus a drawing for prizes?

Pulser

Many *73* readers have built the Bioelectrifier. Several have actually even used it. Every few days I get letters attributing miraculous cures to its use. A few entrepreneurs are supplying the electronic klutz market with ready-to-use units for from $150 to $250 and up.

I've been asked endlessly where people can get the magnetic pulse units Bob Beck devised to knock the HIV virus out of the lymph glands back into the blood, so it can be eliminated with a Bioelectrifier. The pulse unit is so simple to make that there hasn't been much commercial interest in providing them. And that's an opportunity for an entrepreneur.

The pulse unit generates a very short 20,000 gauss pulse via a coil of wire which is held next to the lymph glands. Beck says to use about 150 turns of #14 wire wound on a spool taken out of a VCR tape cassette. This is then wired in series with the flash bulb in an electronic photo strobe unit. Old flash units can be found at flea markets for a buck or two, and you can install a jack to plug in the coil.

Someone interested in making the units commercially should locate an inexpensive source of flash guns, rechargeable batteries, and chargers. It took me less than five minutes to locate several sources of these in the current Hong Kong Trade Development Council catalog. Check [www.tdc.org.hk] for information. Or you can make a trip to Asia this month (October) and catch the huge electronic trade shows in Japan, Korea, Taiwan, and Hong Kong, which are back to back over a two week period every year at this time. For several years I led groups of 200–250 for Commerce Tours [(415) 433-3072]. The tours were very well organized and were a terrific bargain.

If you're interested in supplying pulse units I can put you together with a distributor. Aim for a wholesale price around $50.

What's the market for them? Well, with the explosion of hepatitis C, for which the medical industry has no cure, in addition to the AIDS market, there could be quite a demand. Then, if a few of you baldies will see if you can replicate Beck's regrowth of his male pattern baldness hair using the pulse unit, the lid could be off, with a demand for millions of units. That's a nice market to be in on first.

Beck says he sprayed silver colloid solution on his head and then used the pulse unit a dozen times around his head several times a day. The result was a full head of hair on what had been a desert. Build a unit, give it a serious try, and let me know the results, positive or negative. If it works as Beck says, there are a zillion baldies out there who would give anything to recreate something to comb instead of polish.

How might a few thousand 20,000 gauss blasts affect the brain? With some people I know it can't possibly hurt. Beck doesn't seem to be changed. He's as reclusive and paranoiac as ever. Just hairier. Oh, by the way, Beck is the chap with the basic patents for electronic flash guns.

Creativity

Back in 1960, when I was starting *73*, I tried LSD. I'm very glad I did, for it gave me some valuable insights into life. It was an awesome experience. One of the concepts that came to me at the time was that in a way I was selling part of my soul to my readers, and also that I was stepping on a treadmill which would be inescapable from then on, with a new magazine issue due out every month.

So here I am 38 years later, still on the treadmill, still sharing with you my thoughts and interests — sharing part of my soul with you. Sharing it openly and honestly. Helping those who will let me to live happier, healthier, wealthier and more productive lives. At 76, that's half of my life.

Of course publishing *73* led to my publishing a repeater magazine and books, then to computer magazines and books, then to compact disc magazines and discs. I love the idea of helping new technologies develop. It's exciting and fun.

It really isn't difficult to start a new magazine, once you know the ropes. There are five basic requirements, all of which are obvious, once you think about it. Alas, somewhere around 90% of the people who start new magazines don't think about it. Rule #1: Find a niche market where there is no existing publication. You don't need to compete head to head with an established magazine, like a remora, trying to exist on the scraps left over from a host. Rule #2: Pick a niche where there are a lot of people who will be willing to pay to read articles about their interest. Rule #3: Have an available continuing source of articles that these readers will want to read. Rule #4: Make sure there are businesses that will want to reach this select group of readers and have no other easy way to reach them. Rule #5: Have an editor who lives and breathes the subject.

The other day I picked up *The Granite Server*, a free tabloid, at the local supermarket. The subhead read, "The Technology & Informa-

tion Source for New Hampshire." Hmm. Inside I found nontechnical articles of general uninterest.

The economics of publishing dictate that the revenues are normally split 50-50, with half from circulation and half from advertising. Free or controlled circulation publications have to charge double for advertising, which means that they have to be pretty careful about whom they have for readers. These readers are going to have to spend twice as much with the advertisers as do those of paid circulation publications.

The *Server* seemed to have no circulation discrimination, nor any discernible editorial niche. It also didn't have much advertising. That seemed like a recipe for disaster, so I called the editor and got together with the editor and publisher for lunch at my favorite Chinese buffet. They had not been able to sell many ads, and their few advertisers were complaining about a lack of results. They were (wisely) considering ceasing publication.

I brainstormed with them for a few minutes and was able to come up with a niche for them to fill which fit my five rules. Yes, they've stopped wasting money on the *Server*.

If you keep your eyes, ears and mind open, there are endless niches for new publications — and, for that matter, for new businesses. For instance, with the growing number of dire millennial predictions, how about a magazine devoted to survival technology and strategies? If any of the mass extinction prophecies come about, the people who have made some survival plans will be in a better position to be around to pick up the pieces. They'll want to know about maintaining a pure water supply, what food to store and how, how to prepare to grow new food later, emergency power generation, building and living underground, and so on.

We've been threatened with comets, asteroids, massive solar flares, alien invasions, a third world war, a polar shift, a new ice age, nuclear or biological terrorism, a melting of the ice caps that would destroy most of our major cities, massive earthquakes, and so on.

Can *all* of the doom and gloomers be wrong? Some of them have disturbingly good records for their past predictions. There could be a growing market for survival-oriented products and information.

Then there's the growing dissatisfaction with our worst-in-the-developed-world school system. This is going to mean an interest in alternatives, as well as a magazine reviewing alternative products. Everything that's being "taught" in schools today, plus that which should be being taught, could be produced using top-notch performers and graphics on video. This would not only simplify home schooling, it would allow anyone anywhere to learn about anything that interests them.

A good teacher will know what questions the students will have, and incorporate the answers to those questions in the course. One of the reasons Sherry's how-to-dance videos are so enormously popular is that Kathy Blake, her instructor, has been teaching people for years, so she knows where people normally have problems. Thus, while the famous dancing names have managed to bring out two or three titles on video, Sherry has produced almost a hundred dance videos and they're selling very well. Once someone tries a Kathy Blake video and compares it to anything else on the market, they keep coming back for more.

I believe that within 25 years most education will be delivered via video, with courses being available for any imaginable subject, from grade one to doctorate-level college courses, plus a whole raft of business-oriented courses. The opportunity is there for you to be in this soon-to-grow field either as a supplier or as an information source.

But there are similar opportunities at every turn. If I had the time, I'd love to do a magazine on new building technologies. It would cover new materials such as plastic concrete and foam concrete, underground buildings, new heating technologies, and so on. This would be of interest to architects, building contractors, and people wanting to build homes or business buildings. It would also spur the development of new products and services by making it easy to promote them.

Another coming huge business will be a replacement for the chemical companies which are making us sick. These are the companies which are selling the fertilizers and pesticides our farmers are using to get their crops to grow on mineral-depleted land. The lack of minerals has forced farmers to pour on the NPK (nitrogen, phosphorus, potassium). The resulting sickly crops then require pesticides to kill off the insects which attack sick plants. And we get the benefit of all this in fruits and vegetables which lack the minerals our bodies need to be healthy, plus we get the pesticide residues.

All this can be replaced by new plant growing technologies. I recently cited a dozen of 'em that should be promoted with new products and information sources. Just using already developed new growing technologies, it's possible to grow plants seven times larger than current models, complete with all the missing minerals and no need for pesticides. By the time researchers get through, I expect we'll be seeing ten and even twenty times the size of fruits and vegetables. Right now, using a couple of new technologies, people are growing 400-pound pumpkins and huge, juicy and fabulous tasting tomatoes. Yes, a magazine devoted to plant growing technology is needed.

Well, I could go on and on about new technologies and niches for products and publications. Maybe I ought to hold a seminar. Well, if some hamfests will invite me to speak, and that's what people want to hear about, I'm ready. It would, I suspect, probably be over the ARRL's dead body.

Unfortunately the reality is that you are probably so deeply mesmerized by the "system" that you are going to continue to work for someone else, complete with commuting to work every day, and that you're just irritated by my efforts to upset your beliefs.

Surviving

With the crescendo of millennial doom prophecy books, unless you're living in a coastal city you're giving some thought to at least being a little prepared in case even one of the prophets is right. If you're living in a coastal city no amount of preparation will, I expect, be of much value. For that matter, if you're a ham, what on earth are you doing living in a city anyway? You need some room to grow your antenna farm, particularly now that the HF bands are opening.

As soon as I could after starting *73* in New York City, I moved to New Hampshire where I could put up all the towers and beams I wanted. And did. But now, with the unusual weather confirming many of the dire predictions by prophets, I'm getting more interested in thinking about survival plans.

I'm not sure which doom prediction will pan out (if any), but most of 'em seem reasonably based, so why not have an edge of safety? Between Y2K, the Asian meltdown, the threat from North Korea, ditto Pakistan/India, increasing government corruption, black budgets, nuclear or biological terrorist attacks, polar shifts, a new Ice Age, melting polar ice, killer solar flares, errant comets and asteroids, rapidly increasing numbers of earthquakes and volcanoes, and the weather going berserk, it may be worthwhile to invest a few bucks in survival books.

By the way, when all else fails with communications, we hams will be doing our best to keep people in touch with each other.

Bill Yatchman sent me a copy of his *Bad Times, Good*

Continued on page 62

NEVER SAY DIE

continued from page 61

News, A Practical Guide to Preparedness and Survival. It's a $10 117-page paperback and can be had from Greentree, 2756 W. Hwy. 89A, Sedona AZ 86336; [(602) 282-6601]. Add $3 for s/h.

Another nifty book on the subject is *The Complete Book of Survival* by Stahlberg. It's subtitled, "How to protect yourself against revolution, riots, hurricanes, famine and other natural and man-made disasters." This 1998 288-page large format book is published by Barricade, 150 Fifth Ave. #700, NYC NY 10011.

Magnassager

My thanks to Alan Christian WW6B for a newspaper clipping about a combination magnet and vibrator which is used for massaging. There are a couple of excellent books on magnetism and living things reviewed in my *Guide to Books.* A strong magnetic field seems to ease pain quickly and promote remarkably fast healing of wounds — at the least. Again, we're into an area where the giant pharmaceutical companies that run the medical industry can't get patents, so there's been little funding available for research. Like almost none.

If you know any doctors who might be interested in doing some research, you, being a known electrical genius, might enlist their help in testing the healing power of both electromagnets and strong permanent magnets which are vibrated. I'd test both DC and AC electromagnets to see if the 60 Hz has any effect on the healing, positive or negative. Oh, yes, don't get the magnet near your watch. Or computer discs. Anywhere near.

My friend Don Lorimer has developed a permanent magnet with a major wallop which has been helping veterinarians heal animals after operations in a fraction of the normal time. Since so much of our body works by electrical currents, it's not remarkable that magnets might be helpful in a wide range of ailments. We need a lot more research.

I've had several readers (and Art Bell program listeners) send me information about the Nikken magnets. I suspect these are essentially the same magnets that are being used to hold ads on fridge doors, wrapped in cloth and multi-level marketed with the usual whopping markup. You should be able to get magnets like that from a sign-making supply company and cut them to whatever size and shape you want.

Or you can do like everyone else does and tell Opportunity to get the hell away from your door and stop all that damned racket.

Lobbying

A Texas reader sent me a clipping listing the 1997 lobbyist payments (what they report, anyway). The top player was the AMA, which invested $17.1 million in preserving their $1.5 trillion gravy boat. That's your money, of course, which they are spending. The companies spending millions to lobby feel that they are getting their money's worth or they wouldn't continue to spend (invest). And what does the AMA get for their $17 mil? They buy a government which helps them suppress any inexpensive remedies and doesn't ask questions about why America has the most expensive medical system in the world, along with third-world-class results as compared with most other developed countries.

Right up there in the top lobbying spenders were Pfizer, the Committee to Preserve Medicare, Blue Cross, the American Hospital Association, and pharmaceutical manufacturers. How much protection from Congress did their $54-plus million buy them? Keep that in mind when you read the newspapers. As I said, if it wasn't paying off for them, the money would dry up.

The second biggest buyer of privilege was Philip Morris. Wow, is *that* a surprise! Just in case there was any question in your mind about what happened to the recent attempt at tobacco legislation that sank into quiet oblivion. PM invested $5.8 million, thus helping them to save billions.

Fluoride Update

As Dr. Robert Carlton, a US EPA scientist put it, "Fluoridation is the greatest case of scientific fraud of this century — if not of all time."

With over half of the US municipal water supplies being fluoridated, the chances that you and your family are being poisoned by this stuff is high. Poisoned? Recent studies have linked fluorides with osteoporosis and osteoarthritis, backache, and has been projected to cripple over 10% of people over 60.

For the young married couples, it has been shown in two large Chinese studies to lower children's IQ. This influence can start during pregnancy, when the brain is developing the fastest, and has been confirmed by studies of the brains of aborted fetuses. Oh, yes, there's a much higher rate of miscarriages in areas with artificial fluoridation of the water.

Fluoride damages the central nervous system, causing hyperactivity and learning disabilities in children.

One study showed that the greater the fluoride concentration in the water, the lower the fertility rate for women.

Other studies have shown fluoride to cause neural degeneration and it also seems to enhance the flow of aluminum to the brain, resulting in Alzheimer's symptoms.

So, are you and your family still drinking and bathing in municipal water laced with fluorides? It's okay for flushing your toilet, but it's bad news when taken internally.

Isn't it about time to start either distilling your drinking water, or getting a reverse osmosis filter? Or don't you worry about next week? Or care at all about giving your kids a break in life? Life is tough enough when you give your kids every break you can without permanently dumbing them down right from the beginning.

You know, I keep hearing people wondering why kids today are so out of control — why some kids grab a gun and start shooting classmates. Then I read about the effects of fluorides, sugar, aspartame, fluorescent lights, and other poisons on kids and I wonder why the situation isn't worse.

Drug Deaths

You probably read about the 100,000 deaths a recent study reported in the *Journal of the American Medical Association* that were attributed to bad reactions to prescription drugs. So much for putting trust in your doctor, eh? No, this isn't a new problem and I've written about it before.

In this one-size-fits-all world sometimes our doctors forget that each one of us is different. We look different and our body chemistries are all different. So a drug that may be wonderful for one person can kill another. And does. But other than the 100,000 or so families affected, few people seem to care much about this unnecessary loss of life. But, wow, was there hell to pay when 58,000 Americans were killed over a several year period in Vietnam.

I'm not sure how many of the hundred thou are included in the Ralph Nader study which showed that 180,000 people are killed by negligence in our hospitals every year.

Hospitals are full of sick, and often contagious, people, and their germs and viruses often are distributed on air currents for some remarkable distances, according to some other research reports.

Well, gee, you whine, we all have to go to the hospital now and then. Oh, baloney! I've done a lot of research on this and I'm convinced, as you should know by now, that most of the 11% of the GDP we spend on sickness care is totally unnecessary. Most of us are working determinedly, every day, to make ourselves sick — to make sure we get as little of that Social Secu-

PROPAGATION

Number 63 on your Feedback card

Jim Gray W1XU/7
210 E Chateau
Payson AZ 85541
[jimpeg@netzone.com]

The best days for DX are likely to occur between the 10th and 21st ... 11 or 12 excellent days for your operating pleasure and solid QSOs. The worst days are fewer in number, but are anticipated to take place on the 4th and 5th, and again during the last week of the month, with the 26th and 27th being particularly disturbed. On these dates, look for other geophysical upsets as well, and keep a low profile! The remaining days should trend around F (Fair) conditions.

10–12 meters

Fairly good transequatorial DX should occur during local afternoons. Also, some F2-layer openings on east-west paths to Africa and the South Pacific may be possible in the morning. Short skip out to 2,000 miles or so ought to be available in the afternoon.

15–17 meters

Reasonably good DX to all areas of the world, especially to Africa, South America and South Pacific during daylight hours and peaking in the afternoon. Short-skip openings to distances greater than 1,000 miles should be common.

20 meters

Expect openings to all areas of the world from morning to evening (see band-time-country chart), peaking locally an hour or so after sunrise and again during the afternoon. Short skip beyond 750 miles should be good during the day.

30–40 meters

Fairly good worldwide DX openings may be expected from early evening through sunrise; short skip from 100 to 1,000 miles during the day, and beyond during darkness hours. As always, QRN can be a problem, but should be abating this month.

80–160 meters

On 80 meters, you may find fairly good DX openings to the southern hemisphere during hours of darkness and sunrise; short skip to about 350 miles during the day, and out to between 500 and 2,000 miles at night. On 160 meters, look for DX during the hours of darkness and just before dawn. Short skip should be available from 1,500 to 2,300 miles at night.

Check the bands above and below the suggested ones for possible DX surprises. It's often a good idea to park your receiver on a seemingly unused frequency and just wait. A DX station is very likely to pop up before any one else hears him, and you can snag a good catch. Smart operators don't try to bust pileups unless they have super antennas and kilowatt rigs. Be smart and wily ... like a fox ... and make your play before the pileup starts. Listen, listen, and listen. 73, W1XU/7.

October 1998

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G-F	3 F-P
4 P	5 P	6 P-F	7 F	8 F	9 F-G	10 G
11 G	12 G	13 G	14 G	15 G	16 G-VG	17 VG
18 VG-G	19 G	20 G	21 G	22 G-F	23 F-P	24 P
25 P-VP	26 VP	27 VP-P	28 P-F	29 F-P	30 P	31 P

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20					20	20				15
ARGENTINA	20	20	40	40						10	10	15
AUSTRALIA	15		20			40	20	20				15
CANAL ZONE	15	20	40	40	40		20	20	20	10	10	15
ENGLAND	40	40	40	40			20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20			10	10/15
INDIA							20	20				
JAPAN	15	20					20	20				15
MEXICO	15	20	40	40	40		20	20	20	10	10	15
PHILIPPINES							20	20				
PUERTO RICO	15	20	40	40	40		20	20	20	10	10	15
RUSSIA (C.I.S.)	40	40						15	15	20		
SOUTH AFRICA	20								15	15	10	20
WEST COAST	40	80						20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15											15
ARGENTINA	15	20	20	40	40						10	15
AUSTRALIA	15	20	20	20		40	80					15
CANAL ZONE	15	20	20	40	40			15	15	10	10	15
ENGLAND		40/80	40/80			15/20	15	15	20	20	20	
HAWAII	15	20	20	40	40	40	80	20			10	15
INDIA								20				
JAPAN	15											15
MEXICO	15	20	20	40	40			15	15	10	10	15
PHILIPPINES	15	20						20				
PUERTO RICO	15	20	20	40	40			15	15	10	10	15
RUSSIA (C.I.S.)								20	15	20		
SOUTH AFRICA	20									15	15	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	15	20	20	20	40	40				15
ARGENTINA	10/15	20	20	40							15	10/15
AUSTRALIA	10	15	15	20	20	40	40	40	20	20	15/20	15
CANAL ZONE	20	20	40/20	40/20	40			20	15	15	10	10
ENGLAND										15/20	15-20	
HAWAII	10	15	20/15	40	40	40	40	40		20	20	20
INDIA	15/20	15/20							20			
JAPAN	10/15	15	15	20	20	20	40	40				15
MEXICO	20	20	40/20	40/20	40			20	15	15	10	10
PHILIPPINES	15/20	15/20		20		40	40		20	20		15
PUERTO RICO	20	20	40/20	40/20	40			20	15	15	10	10
RUSSIA (C.I.S.)									20			
SOUTH AFRICA	20	20								15	15	20/15
EAST COAST	40	80						20	20	20	15	40

rity pittance as possible, and as much as we can of Medicare and our sickness insurance. We do it when we eat cooked disorganic food and when we dump poisons into our bodies. We do it with stress and EMFs. Yes, I'm repeating myself and you aren't going to change your habits one whit.

Brrrr

A letter from geologist reader Jack Sauers cites several published reports that the glaciers in Greenland, Antarctica, Norway, Sweden, and the Bering Sea are strongly increasing in mass. The Douglas fir trees have declined in elevation by 1000 feet in the past 650 years.

Botanists are rushing to develop grain crops that can better stand the cold and the fungi that the colder climate will bring. The colder weather has been decimating the wheat crop and raising hell with potatoes. The potato industry estimates that it lost $7 billion this year to the potato blight.

With the temperatures along the northwestern states down about 9° F since 1950, and headed down to over 10° lower by 2007, we could be heading for a serious food

Number 64 on your Feedback card

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the January 1999 classified ad section is November 10, 1998.

COLLOIDAL SILVER GENERATOR! Why buy a "box of batteries" for hundreds of dollars? Current regulated, AC powered, fully assembled with #12 AWG silver electrodes, $74.50. Same, but DC powered, $54.50. Add $2.50 shipping. **Thomas Miller**, 314 South 9th Street, Richmond IN 47374. BNB342

TELEGRAPH COLLECTOR'S PRICE GUIDE: 250 pictures/prices. $12 postpaid. **ARTIFAX BOOKS**, Box 88, Maynard MA 01754. Telegraph Museum: [http://wltp.com] BNB113

BIOELECTRIFIER™ 5 Hz micro current supply for plant and animal research. Semi-Kit $38.00. Assembled complete with batteries and silver electrodes $89.50. Add $2.50 postage. **Thomas Miller**, 314 South 9th Street, Richmond IN 47374. BNB343

Tormet's Electronics Bench Reference has over 100 pages of circuits, design information, large radio section, parts sources, etc. See details at [www.ohio.net/~rtormet/index.htm], **or** send check or money order for $19.95+$2.50 postage and handling to **RMT Engineering**, 6863 Buffham Rd., Seville OH 44273. BNB 529

WANTED: NYE VIKING STATION MONITOR RFM-003, RFM-005. Paying $600. Randy Ballard N5WV, **(903) 687-3002**; [TMT@Prysm.net]. BNB5001

WWII MILITARY TELEVISION WANTED: Army/Navy SCR, ATJ, ATK, ARK, ARJ, CEK, CRV. Receivers, cameras, monitor, transmitters, dynamotors. **Maurice Schechter**, 590 Willis Ave., Williston Park NY 11596, P/F (516) 294-4416. BNB69

supply shortage. The weather change has taken tropical rains to higher latitudes, increasing glacier growth in the north and bringing drought to Texas and Oklahoma.

With the world consuming 26 billion barrels of oil annually, but finding only 6 billion barrels, we'd better start leaning on our cold fusion researchers to start coming up with some practical products. The price for oil can only go up and the need for heating oil only increase.

I think it's time for me to seriously consider getting a wood stove. Just in case. We sure could have used one last winter when the worst ice storm in history hit the Northeast. Our power was out for five days.

MAHLON LOOMIS, INVENTOR OF RADIO, by Thomas Appleby (copyright 1967). Second printing available from **JOHAN K.V. SVANHOLM N3RF**, SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044. Please send $25.00 donation with $5.00 for S&H. BNB420

ALPHA 86 1500 watt amp. Two spare 3CX800A7 $1,750.00. ICOM 761 with all filters, SM8, SP20, $950.00. Kenwood **SM-220** Scope $325.00. Bird 43P with 5 elements $350.00. PK232 MBX, $175.00. Contact **George AB6A** at [g.sanso@ mci2000.com]. BNB100

Scanner collector selling out. Too many to list. Handheld, home and car units. Many are unblocked (have full 800 MHz). Dallas TX area, can ship anywhere. **(817) 595-6568**. BNB524

ASTRON power supply, brand-new w/ warranty, RS20M $99, RS35M $145, RS50M $209, RS70M $249, **AVT**. Call for other models. **(626) 286-0118**. BNB411

SELL QRP++ (UPGRADED), MANUAL, POWER CABLE, HAND AND DESK MIKES. EXCELLENT RIG. $400 MONEY ORDER. SHIPPING INCLUDED. W4LJD, BOX 30, SALINAS PR 00751-0030. BNB340

Cash for Collins: Buy any Collins Equipment. **Leo KJ6HI.** Tel./FAX (310) 670-6969. [radioleo@earthlink. net] BNB425

QSL CARDS. Basic Styles; Black and White and Color Picture Cards; Custom Printed. Send 2 stamps for samples and literature. RAUM'S, 8617 Orchard Rd., Coopersburg PA 18036. Phone or FAX (215) 679-7238. BNB519

RF TRANSISTORS TUBES 2SC2879, 2SC1971, 2SC1972, MRF247, MRF455, MB8719, 2SC1307, 2SC2029, MRF454, 2SC3133, 4CX250B, 12DQ6, 6KG6A, etc. **WESTGATE**, 1 (800) 213-4563. BNB6000

FREE: Scanner collector's methods and secrets. Learn how to buy, sell, trade and USE scanners in the most efficient manner. Enclose $2.00 for postage and handling to: P.O. Box 402, Decatur TX 76234. BNB523

METHOD TO LEARN MORSE CODE FAST AND WITHOUT HANGUPS Johan N3RF, Send $1.00 & SASE. SVANHOLM RESEARCH LABORATORIES, P.O. Box 81, Washington DC 20044 USA. BNB421

HEATH COMPANY is selling photocopies of most Heathkit manuals. Only authorized source for copyright manuals. **Phone:** (616) 925-5899, 8–4 ET. BNB964

WANTED: High capacity 12 volt solar panels for repeater. **[kk4ww@ fairs.org]** or (540) 763-2321. BNB2630

Radio Bookshop

ORDER FORM

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 4 weeks for delivery. (Prices subject to change without notice if suppliers increase prices or new editions cost us more.)

ITEM	TITLE	QTY	PRICE	TOTAL

Shipping: All orders add $5.00 handling *plus there is an additional at cost shipping charge added to all foreign orders. We ship UPS where possible, please give us street address.

S&H* ______

TOTAL $ ______

Make checks payable to "Radio Bookshop."

Foreign Orders: Choose one ☐ surface shipping ☐ air shipping

(Surface delivery may take 2-3 months.)

*Note: The actual foreign shipping costs will be additional to the regular shipping and handling fees.

Name ______________ Phone ______________

Address ______________

City ________ State ____ Zip ____ Country ______

$10 minimum for credit card orders

Total Paid $ ☐Check/Money Order ☐AMEX ☐MC ☐VISA

Card # ______________ Expires ______

Signature ______________ Date ______

Telephone: 603-924-0058, 800-274-7373, FAX 603-924-8613

Mail: Radio Bookshop, Dept. 1098, 70 Route 202 N, Peterborough NH 03458

☐ YES, Send me 12 issues of 73 at the low rate of $24.97 (save 47% over the cover price). Canada add $7 plus $1.40 GST; Foreign add $19 surface; $42 airmail.

NOVEMBER 1998
ISSUE #458
USA $3.95
CANADA $4.95

73 Amateur Radio Today

Dr. Michel Oliver XE1MD

Build a:

Rx Antenna Booster
VHF/UHF Signal Source
Tiny Fox Hunt Xmtr
Capacitor Tester

Review:

Hamtronics R301 2m Rx — a dilly!

Business Office
Editorial - Advertising - Circulation
Feedback - Product Reviews
73 Amateur Radio Today Magazine
70 Route 202N
Peterborough NH 03458-1107
603-924-0058
Fax: 603-924-8613

Reprints: $3 per article
Back issues: $5 each

Printed in the USA

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

NOVEMBER 1998
ISSUE #458

73® Amateur Radio Today

TABLE OF CONTENTS

FEATURES

REVIEW

DEPARTMENTS

On the cover: Dr. Michel Oliver XE1MD is a retired medical doctor who emigrated from France to Mexico in 1962. He is author of *El Arte del DX.* Photo by WB2AQC. Article begins on page 34.

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine. No part of this publication November be reproduced without written permission of the publisher, which is not all that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today.* You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73.* What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Incentive Licensing

What a crock! The whole idea that different license classes are going to get amateurs to increase their skills is ludicrous. Proven so by experience! Our license exams are no more than exercises in memorization. We go through the ARRL Q&A manual, we memorize, and we pass the tests. It has little to do with understanding any of the concepts involved in electronics and radio or antenna theory. The whole basis for the different license classes is based on a house of cards.

If you have any technical smarts at all you can quickly detect their lack in 99% of the people you contact on the air. I see it reflected in 99% of the mail I get. This may, at one time, have been a technical hobby, but it hasn't been for quite a few years. It's now a hobby where a few thousand old white men have invested a couple thousand dollars in a rig and antenna and sit there flapping their aging jaws until they die of malnutrition (bad nutrition). If the rig stops working it goes back for factory service.

The recent ARRL proposal to simplify our licensing structure is a mile short of hitting the nail. Let's stop all this baloney and call a spade a digging instrument or a card suit. We only need one class of license. We don't need Novice, Tech, General, Advanced, and Extra. We don't need to go back 50 years to Class A, B, and C either.

The true incentive for us to learn lies in the promotion of different modes of communication. You don't get on packet without learning a lot. Ditto RTTY, slow scan and so on. That's the incentive it takes to build our skills, not a memorized test. Hey, it's *fun* to learn. It's exciting to get involved with satellite communications, and once you do you'll learn infinitely more than you will from any Q&A manual.

It's a ball to put together a couple of simple 10 GHz transceivers and take them to mountaintops and start making contacts. WA1KPS and I did this and had a time neither of us will ever forget. Like the time Chuck climbed a tree on the highest hill in Rhode Island and hauled his little rig up there, complete with a three-foot dish. Aiming his dish at my mountain in New Hampshire wasn't easy up there in the tree branches, using the other hand to keep in touch with me on two meters while I tuned for his signal from the top of 3,166-foot Mt. Monadnock in New Hampshire, where I'd climbed with the other rig and a similar dish. We made the contact 5-9+ solid before a farmer with a shotgun chased Chuck out of the tree. We went on to make 10 GHz contacts with all the New England states and New York, all with a tenth of a watt — with one contact over 100 miles and all over 50.

Forcing us to memorize Q&A manuals doesn't build any skills. We build our skills by doing.

The whole concept of incentive licensing is a hoax. It's a scam the ARRL has rammed down our throats and it's helping to kill the hobby. Unfortunately, with your voting cooperation, the League directors are dominated by a little group of old men (white) who seem more interested in protecting their privileges than in preserving the hobby.

When the ARRL first proposed incentive licensing in 1963, it almost killed the hobby. It was submitting their incentive licensing proposal to the FCC in 1963 that killed off within two years over 85% of our ham stores and about 95% of our ham industry. It also led to the stopping of our growth, which had been a steady 11% a year for the previous 17 years. We went into a negative growth period which was only stopped by the introduction of 2m FM and repeaters in 1970. After that we had a growth rate around 1% until the no-code license was introduced.

The worst damage of all was the almost total destruction of the school radio clubs the incentive licensing proposal caused. These had been the main entry route into the hobby, so when they were killed off we lost the infrastructure that had introduced kids to hamming. Before this proposal an ARRL study showed that 80% of all new licensees were teenagers, with 50% being either 14 or 15 years old. Today we're seeing youngsters being about 12% of the newcomers. Can we ever replace this resource? Not without a massive effort. It isn't easy to regrow a destroyed infrastructure. But without thousands of school radio clubs, the future for the hobby looks bleak.

I was 14 when I got interested in amateur radio. I joined the school club (W2ANU) and they helped me with the code. The club had been active since the 1920s and had around 50 members when I was there. It blew away in 1964.

Incentive licensing is a bummer and is killing the hobby, with no perceivable benefits — other than the sale of ARRL Q&A manuals. Let's dump it and have one license. Now, get busy and let the FCC know how you feel.

Code Preservation

A clipping from Clark Smith KE4OZN out of *Popular Science* showed a new Army communications system for battlefield use which provides a secure communication system capable of moving 1.2 gigabytes per second. Hmm, that's about the same throughput of information as 83,916,000 hams could provide per minute at 13-per. Obviously we're going to need a whole lot more hams if we're going to keep up with military technology. Please keep after the ARRL to provide a program that will give us at least 100 million hams so we won't get left so far behind.

Now It's Cough Syrup!

Most cough syrups contain dextromethorphan. A recent study has shown that even after just one dose of this powerful stuff it can cause miscarriages and birth defects. Researchers recommend that pregnant women should avoid all cough medicines and that syrups that contain this stuff be avoided. It's also bad news for people with asthma, a chronic cough, or liver disease.

What they're saying is that cough syrup is bad news. Period.

Adverse Drug Reactions

Researchers have found that more than 100,000 deaths are caused every year in the US from adverse drug reactions. This makes them the fourth biggest killer, after heart disease, cancer and stroke. And this doesn't count deaths due to overdoses and hospital errors. 5% of all hospital admissions are caused by drug

reactions, and once there, 15% of the patients have their stay prolonged by a drug reaction.

As I've written before, heart disease, cancer and stroke are, I'm now convinced, totally avoidable if you change your living habits. Alas, most people would rather get sick and die 30–60 years earlier than needed than change their habits. And this, I suspect, includes you — and your children, who learn their habits from you.

Responsibility

Just a minute while I adjust my surplice and cassock before the sermon.

Okay, that's better. Now let's talk about responsibility. Hmm, I see your eyes shifting around guiltily. We're taught from the earliest age to do our best to avoid responsibility, despite the totally fabricated example of George Washington admitting that he chopped down the cherry tree. Most of us would have found someone else to blame, and never mind the hatchet in our hand which we ... er, just picked up.

We know that those "responsible" are going to get punished. "Responsible" has powerful negative connotations.

Now, getting specific, we're also taught by our family, friends, and schools that we can eat anything we want, and if we get sick we go to the doctor and then it's *his* responsibility to cure us. My sermon today is on your agreeing to accept the responsibility for your own health. The things you put in your mouth, spray on your body, inject into it or breathe can make you sick. They have done so and will continue to as long as you refuse to accept the responsibility for your own health.

When you screw up, a doctor may possibly be able to help, though I'm not completely convinced of that. You only have to read a few exposés of the medical industry before you begin to get a different perspective on the medical profession.

If you abuse your body it's mostly a question of when it's going to start breaking down, not if. Which is why I've been such an itch about your doing your homework on nutrition and learning about the dangers of poisons.

For instance, anyone who smokes or drinks Coke® is an abuser and is not accepting the responsibility for their health. Ditto TV dinner addicts, and so on.

Say "Amen."

Wisdom

Just as you can go through your life eating and drinking whatever you feel like, and never mind the consequences to your health — after all, we have doctors to repair the damage you do to your body, right? — we also are taught to go through life doing what we feel like, with no long range goals. Well, we do have to go to school, whether we want to or not — the government forces us and our parents to do that.

On the health aspect, doctors don't actually repair the damage we do, they lessen the pain we've caused. They treat symptoms, not causes. Well, I've written that endlessly, but it hasn't stopped you from smoking, being seriously overweight, drinking beer, and so on. When am I going to stop lecturing to deaf ears and blind eyes? Probably never.

Now, getting to wisdom. This has little to do with inherited IQ. This is a matter of the information you've put into your brain. The slow, painful route for data input is via school, where around 99% of the data you get will be of little use (and soon forgotten). The most efficient mode of data input is via reading books — books written by people who are both experts in their field, and also experts at making the data easy to understand. That kind of weeds out 99.99% or more of the books being published.

How have you used your spare time through your life? Reading books which add to your wisdom? Watching TV? Listening to the radio? Watching sports? Teens waste some of the most valuable years of their lives cruising and hanging around. Or, if they are hams, getting on a round table and talking about nothing at all for hours, days, years. Or chasing DX for a 15-second signal report.

How Come?

Yeah, how come Wayne is writing all these long editorials? One thing I haven't done in all my 47 years of writing editorials is give some background as to how I happened. Well, I figured my readers would be more interested in what I had to say about things than about me personally.

I was born in 1922 in Littleton, NH. My mother was a commercial artist and my dad was an aviator with the Army Air Force, stationed at Langley Field, VA. He took me up in a Martin bomber when I was about two months old, so I got an early start.

My great grandfather was a pioneer in homeopathy. He was the town doctor in Littleton, where my father also was born. A Green published the first Bible in America, and Greens founded Greene County, NY and Green County, MI. A Greene also founded Rhode Island, but it's a small state, so that probably isn't very important.

By an odd coincidence, all of my ancestors, from every branch of the family, came over here before 1700. Pioneers.

My grandfather was an inventor. A successful inventor. It was his inventions that got Citgo started back in 1910, and during the depression in the 1930s he turned Continental Can around, saving them from bankruptcy.

So I was ripe for amateur radio when I was a kid and started building radios when I

Continued on page 58

Number 6 on your Feedback card

LETTERS

From the Ham Shack

Feedback from Down Under

Frank Wright VK4SE. Here is an interesting little circuit that can be used to turn Bob Beck's magnetic pulse generator on automatically.

My xenon flash gun takes six seconds to turn on, so I designed an automatic pulse circuit to give a pulse every seven seconds. A 6–8 V SPDT 225 ohm relay, or similar, gives one pulse every seven seconds. Two wires from the normally-open contacts short-circuit the flash button in the gun, activating the xenon tube. If you find it difficult to get to the contacts of the flash button in your gun, it is best to get a camera technician to connect the wires for you.

Alternatively, a camera technician could remove the printed circuit board from the gun (if you can't do it yourself), indicating the flash button wire and the battery wires. It can then be mounted in a neat little case, as I did with mine. I used a six-volt plugpack to power it. C1 is the timing capacitor: select a capacitor that will suit the timing of your flash gun. Start with 10 μF and work upwards until the correct timing is found, or use the formula R1 + R2 x C for time in seconds. It is best not to power the pulse circuit from the same plugpack that powers the flash gun, as initial loading can increase the pulse time.

I use batteries to power mine, either a single 9 V battery or 18 V into a 7809 three-terminal regulator. Both methods work well.

(Ed. note: You can learn more about Bob Beck's magnetic pulse generator and colloidal silver by requesting the appropriate information when you write to Wayne at LDI, Box 1729, Hillsboro NH 03244.)

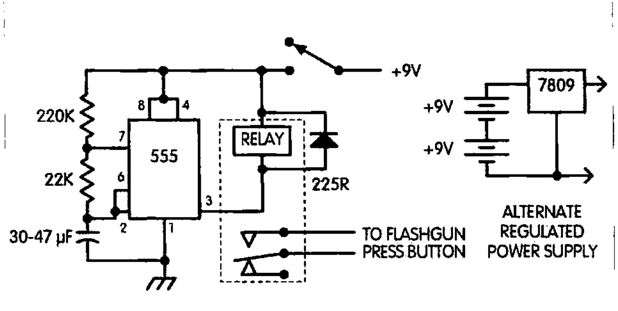


Fig 1. Pulse circuit.

More Aussie Advice

Frank Wright VK4SE. This circuit is very simple, yet surprisingly good for testing the purity of filtered water from distillers, and other water purifiers, prior to making colloidal silver.

Distillers have a "post-carbon" filter which often contains a fairly high level of impurities when new, and about 10 liters of water has to pass through them before the impurities are washed out. This little circuit will detect impurities and test the water from zero parts per million (PPM) to 20 PPM accurately. Beyond 20 PPM readings get a little less linear. It can be calibrated against a commercial TDS meter, if you can borrow one, or perhaps you can get a pure-water distributor to calibrate it for you. Water from a distiller should give a reading of 1 μA on any 50 μA meter, which is equivalent to zero parts per million. Here are some readings I get on my meter:

6 μA = 5 PPM
12 μA = 10 PPM
15 μA = 15 PPM
20 μA = 20 PPM
23 μA = 25 PPM.

Different meters will, of course, give different readings, but they are all accurate up to 20 PPM. Beyond that the scale becomes gradually more crowded. My tap water reads 42 μA. The water to be tested is poured into a small cup which plugs into the meter. This is how I made my cup:

I used two 50 mm (2-3/16") end stops for PVC pipes. Two stainless steel self-tapping screws (#6-3/4") are screwed into cup **a**, one and one-eighths inch apart, and electrician's wire nuts are fitted on their undersides to connect the wires. Cup **a** sits on top of cup **b** and is held firmly in place with insulation tape or duct tape. To test the water, fill cup **a** to one-eighths inch from the top, plug into meter and operate the DPDT center off switch to "W" (water test position). To test the battery, operate the switch to "B," the battery test position, and get full-scale deflection for a good battery.

Open the circuit one wire to the meter. M1. Set RV2 at maximum resistance. Connect a digital voltmeter to the slider of RV1, and 0 V. Adjust RV1 for a reading of 0.5 V. Reconnect meter m1, short circuit the input jack by operating the switch to the battery test position and adjust RV2 for full scale deflection on the meter. That's all there is to it.

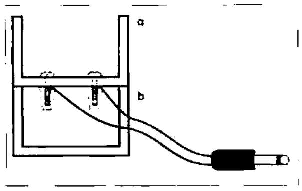


Fig. 2. Water test cup.

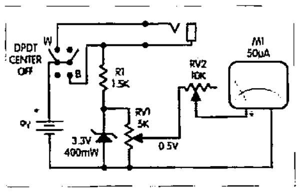


Fig. 3. Water test meter.

My meter fits easily into a small instrument case measuring four inches long by two and a half inches wide by one and a half inches deep (4" x 2-1/2" x 1-1/2").

Readers wishing to communicate directly with Frank Wright VK4SE may write to him at 2 Croxley St., Toowoomba, Queensland, Australia 4350.

Ron Barensten KF7N, Bellevue WA. So you want feedback? In the June issue the "The Fun of Building" caught my eye because I recall an earlier editorial that mentioned Ramsey Electronics. After reading the older comment, I called Ramsey and ordered their small phase-locked FM transmitter that could broadcast audio in the FM band. Some time before you mentioned Ramsey, I had been contemplating ways I could have the same music available in most of the rooms in my home. Running speaker lines everywhere was impractical. I did have small to large hi-fi gear in almost every room, but the thought of running shielded audio lines with all of the attendant technical problems of hum, fidelity loss, and mechanical installation headaches ruled out that approach. Then came your comment about Ramsey. One week later the kit arrived in the mail. I had not put a kit together since the late 50s, but the juices returned quickly. I cut off the top of a corrugated cardboard carton, bent it so that it would sit with the corrugated holes vertical, and inserted all of the small parts with leads in the holes. After a quick look at the construction manual, I began assembly.

Continued on page 55

QRX . . .

Number 8 on your Feedback card

No SAREX, but Walter's Back!

While the Space Amateur Radio Experiment (SAREX) payload won't be aboard the shuttle flight that carries US senator and astronaut John Glenn into space this fall, renowned former TV newsman Walter Cronkite KB2GSD will be back in the anchor chair for the historic flight.

Now 81 and retired from his long-held anchor position at CBS since 1981, he will report on Glenn's return to space for CNN. Cronkite, who anchored Glenn's original 1962 space mission, will cover Glenn's nine-day mission aboard the space shuttle *Discovery*, including the October 29 launch and November 7 landing.

Two hams, US astronaut Scott Parazynski KC5RSY, and European Space Agency astronaut Pedro Duque KC5RGG, of Spain, will be among the international crew aboard *STS-95*.

From *The ARRL Letter*, via September 1998's *Badger State Smoke Signals*, acting editor, Jim Romelfanger K9ZZ.

"... and Now for the Weather ..."

Packing winds of more than 100 miles an hour, Hurricane Georges slammed into the Mississippi coastline September 28th, 1998. Alabama and Florida were hit hard as well. More than two feet of rain caused extensive flooding. Before, during, and after Georges' approach, radio amateurs were busy, providing communications support. Tom Moore KL7Q is a District Emergency Coordinator in Lee County, Alabama. He says hams in Alabama's Mobile and Baldwin counties had their hands full.

According to Moore, communications took place on a variety of bands, including VHF, HF, 75 and 40 meters.

Many different amateur radio groups pulled together to provide communications support to Red Cross and emergency management agencies. Moore says hams were active in more than half a dozen south Alabama counties, including Covington County.

Hams also provided SKYWARN support services because of Georges' threat of tornadoes, he added.

Farther inland, hams in west Alabama were busy helping storm refugees. Radio amateurs in Tuscaloosa manned two locations for the Red Cross, including a storm shelter.

Before Hurricane Georges made landfall in the United States, it was responsible for a lot of death and destruction across the Caribbean. And ham radio was there as Georges blew away most traditional lines of communications. The Hurricane Watch Net was active on 14.325 MHz to coordinate storm reports with W4EHW at the National Hurricane Center. Hurricane Watch Net Manager Jerry Herman N3BDW said that the net got good reports from Cuban hams.

"Arnie CO2KK was passing radar data and observations that the Hurricane Center was not getting from official sources," he reported. Another net handled health and welfare traffic on 14.283 MHz.

Meanwhile, hams in Puerto Rico were assisting in the aftermath of Hurricane Georges, which inflicted heavy damage in parts of the Commonwealth. Some amateurs have been able to return to the airwaves.

"Hams have made a difference here," stated Rafael Medina NP3HA, in Guaynabo. Medina says he used the WP4KYP UHF repeater to make contact with WP4EZC who, in turn, contacted his relatives to inform them his family was OK.

"I also used the repeater to contact people on the center of the island to gather information and needs from the counties there," he said.

He also passed along VHF repeater traffic to coordinate local needs. "Civil Defense is using hams to operate the repeater to gather information from different regions of the island," he said.

"They are providing service to the police and medical services." Medina said government agencies were taking advantage of communication capabilities provided by ham repeaters that remained up.

Power was knocked out over much of Puerto Rico, and telephone service remained spotty. According to Internet reports, Hurricane Georges took out five ham radio towers at the QTH of well-known contester Pedro Piza NP4A.

As Hurricane Georges faded into oblivion, there were two other hurricanes out in the Atlantic, and hams remained on alert for whatever Mother Nature had in store.

TNX Bill Pasternak WA6ITF at *Newsline*.

Where Were You On the Morning of the 27th?

The National Radio Astronomy Observatory in Socorro, New Mexico, needs hams to file reports on what they heard on any band on Sunday, September 27th, especially on 40 meters and below. That's because September 27th was the day that a major gamma ray burst from a neutron star 15,000 light years away hit our Earth.

This solar event occurred at 1022 UTC. The burst was so strong, it ionized the E- and F-layers on the night side of the Earth. It also ionized the D-layer for extreme absorption for many minutes, and saturated gamma and X-ray sensors on satellites.

This was an extremely rare astronomical event, caused by a generation of power so intense it is almost beyond explanation.

Only two other major gamma ray bursts have ever been detected, one in 1979 and another in 1984.

Paul Harden NA5N, at the New Mexico observatory, says that experimental physics Very Low Frequency monitoring circuits maintained by Stanford University recorded radio wave absorption down to the tens of kHz. But, because this event occurred in the very early morning hours in the US, there is virtually no record of it.

This is where *you* come in.

If you have any recollection of this event, or specific data from, say, a QSO in progress, then Paul Harden wants to hear from you. His E-mail address is [pharden@nrao.edu].

NA5N says that this is a real opportunity for hams to make a contribution to a rare scientific study if you were lucky enough to witness it in some form or another.

TNX Jay Miller WA5WHN in Albuquerque and Bill Pasternak WA6ITF at *Newsline*.

The Ham's 10 Commandments

•Thou shalt have no other hobby but radio.

•Thou shalt not transmit unto others signals that thou canst not read thyself.

•Thou shalt love, honor and obey the Radio Inspector, that thy days as a ham may be lengthened.

•Thou shalt not covet thy neighbor's beam, nor his final, nor his DX, nor his YL, nor anything that is his.

•Thou shalt not screw down thy gear, lest thy neighbor take offense at thine installation; rather should thou keep a keen eye on him.

•Thou shalt not, when emergency comes upon thee, hold back thy assistance.

•Thou shalt not jam thy fellow ham's signal, lest he should jam thine.

•Thou shalt take offense at thy harmonics, and descend lustily upon them, ere they crawl down thy neighbor's antenna.

•Thou shalt ever keep the *ARRL Handbook* at thine elbow, whence shall thy knowledge of radio improve.

•Difficult as it may be, thou shalt even consider a CW operator a human being, dealing with him by tact and diplomacy.

Drafted by Bob Taylor ZS6CO (SK). Submitted by Alf Zeller ZS6AA (SK). Adapted by Johann von Rooyen ZS6L, and seen in September 1998's *Static*, newsletter of the North Hills ARC of Wexford PA. Also seen in the September 1998 issue of *NOARS Log*, newsletter of the Northern Ohio ARS, Mike Willemin W8EU, editor, so chances are pretty good you'll see it somewhere else, too!

FCC Shifts Amateur Radio Enforcement Functions

The Federal Communications Commission announced a change in the handling ol enforcement actions concerning the Amateur Radio Service. As of September 1, 1998, the Compliance and Information Bureau is assuming the duties of policing the activities of the nation's 750,000+ hams. Up until now, ham radio rules enforcement has been under the purview of the Wireless Telecommunications Bureau and its predecessors.

The change is the result of an internal arrangement between the Compliance and Information Bureau and the Wireless Telecommunications Bureau. Under it, all investigation, evaluation, and processing of radio amateur-related enforcement matters has been transferred to the C.I.B.

What this means in the real world of enforcing the Part 97 rules is unclear. Officially, the FCC seems to view the move as nothing more than an internal bookkeeping shift. But some insight as to what it really might mean may be found in the words of the FCC's Joe Monie. Monie was speaking at an FCC Forum at September's Radio Expo in Chicago. According to Monie, the Wireless Telecommunications Bureau will no longer handle complaints of interference. The Compliance and Information Bureau will be responsible for that function.

Monie warned rules violators to look for stepped-up enforcement, to the best of the bureau's ability, based on the resources and funding available.

TNX Bill Pasternak WA6ITF at *Newsline*.

Useful Internet Proverbs

•Home is where you hang your @.
•The E-mail of the species is more deadly than the mail.
•A journey of a thousand sites begins with a single click.
•You can't teach a new mouse old clicks.
•Great groups from little icons grow.
•Speak softly and carry a cellular phone.
•C: is the root of all directories.
•Don't put all your hypes in one home page.
•Pentium wise; pen and paper foolish.
•The modem is the message.
•Too many clicks spoil the browse.
•The geek shall inherit the Earth.
•A chat has nine lives.
•Don't byte off more than you can view.
•FAX is stranger than fiction.
•What boots up must come down.
•Windows will never cease.
•In Gates we trust.
•Virtual reality is its own reward.
•Modulation in all things.
•A user and his leisure times are soon parted.
•There's no place like <http://www.home.com/>.
•Know what to expect before you connect.
•Oh, what a tangled Web site we weave when first we practice.
•Speed thrills.
•Give a man a fish and you feed him for a day; teach him to use the Net and he won't bother you for weeks.

Borrowed from the September 1998 issue of *ARNS Bulletin*, Steve Auyer N2TKX, editor, who got it from the July/August 1998 issue of *The LongWire*, the newsletter of the Liverpool Amateur Repeater Club, Bob Jackson WB2BJW, editor.

Amateur Radio Bumper Stickers ... as seen in lots of places!

•Old radio nuts never die, they just fade into the noise.
•Old boat anchor users never die, they just go down the tubes.
•Save heavy metal—recycle a Hammarlund or Johnson!
•No glass, no classl
•73, 88, and 6146
•If you have to ask "What's a boat anchor?," you won't understand the answer.
•Real radios glow in the dark!
•Keep your eyes on the meter and your nose off the plate cap.
•807s for everyone!
•Honk If You Love Slide Rule Dials
•I Brake for Hamfests!

Thanks to the September 1998 issue of *Static*, newsletter of the North Hills ARC of Wexford PA.

Why Radio Amateurs Are Called "Hams"

Have you ever wondered why radio amateurs are called "HAMS"? Well, it goes like this: The word "HAM," as applied in 1908, was the station call of the first amateur wireless stations operated by some amateurs of the Harvard Radio Club. They were Albert S. Hyman, Bob Almy, and Poogie Murray. At first they called their station "Hyman-Almy-Murray." Tapping out such a long name in code soon became tiresome and called for a revision. They changed it to "HYALMU," using the first two letters of each of their names. Early in 1910, some confusion resulted between signals from the amateur wireless station "HYALMU" and a Mexican ship named *Hyalmo*. They decided to use only the first letter of each name, and the station call became "HAM."

In the early pioneer days of unregulated radio, amateur operators picked their own frequency and call letters. Then, as now, some amateurs had better signals than commercial stations. The resulting interference came to the attention of congressional

Continued on page 56

Build the FoxTTL Foxhunt Transmitter

Simple, inexpensive, and the end of your excuses for not trying T-hunting.

Dave Pelaez AH2AR/8
4872 Trailside Court
Huber Heights OH 45424
E-mail: [ah2ar@webtv.net]

The popularity of high-altitude amateur radio balloon launches has increased exponentially within the last seven years. A balloon launch that I organized in 1991 for the Dayton Amateur Radio Association included a veteran recovery team from Indianapolis who volunteered to participate in the chase. As luck would have it, the balloon was hijacked by the jet stream, and in less than 50 minutes, the balloon payload parachuted back to *terra firma* over 115 miles away in the Wayne National Forest—the only part of Ohio where the lines on a topographical map resemble the scan lines on a high-resolution monitor!

The signal path through the many "hollers" and ridges was so convoluted that it was just about impossible to pick up a signal from the payload resting on the forest floor. By the time a private aircraft flew over the suspected landing area, the batteries had gone dead and the package had fallen silent. For the next eight months, the payload lay undisturbed, until it was found by a turkey hunter, who obligingly called the telephone number on its exterior and claimed the reward. The package did not contain the one feature that would have meant quick retrieval: a long-term beacon operating at low power.

I immediately decided that the *next* balloon flight would contain an additional low-power beacon transmitter that would assist, if needed, in a speedier recovery. After toying with a few ideas, I built a small QRP transmitter that contained a number of useful features.

The ideal transmitter would have a low parts count and would operate on two meters FM, so almost anyone who owned a two-meter radio could participate in the recovery operation. Low power was also a requirement, to ensure that reserve battery capacity would not be a limiting factor. Extra battery time can be the difference between being lost or found. Sturdiness is also a must—a balloon payload makes a lousy place to store fragile items!

As a spin-off of the balloon recovery transmitter, I designed a similar QRP FM two-meter foxhunt transmitter, powered by a standard nine-volt battery, that has proven to be an extremely popular item; I made it available at my flea market table at the Dayton Hamvention. Simplicity, ruggedness, low power, small size and low cost are features that make this transmitter a popular choice among foxhunters who are looking for a simple transmitter for newcomer hunts in small areas. The FoxTTL is terrific for teaching foxhunting basics in a small park, or even in an auditorium. Maximum range for the FoxTTL is a half mile or so. It is easier for an instructor to demonstrate techniques, such as body shielding, and at closer ranges, the transmitter helps to scale down foxhunting to what normally takes several hundred square miles in some Southern California T-Hunts.

About the design

I designed this circuit so an FM signal with a unique stepped audio tone would be produced with an absolutely minimum number of parts. This is possible by employing a TTL clock oscillator, a 555 timer and a flashing LED. The TTL clock oscillator, designed to provide a clock signal to drive computer video displays, is used as the basic transmitter building block. Cut for 48.3 MHz, the clock oscillator used in this article is made by Cal Crystal Labs, Inc., in Anaheim, California. Using a bandpass filter consisting of four

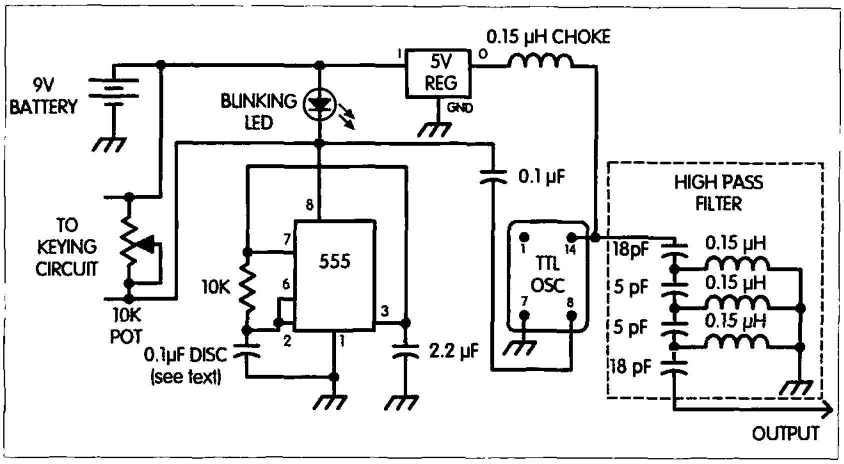


Fig. 1. Schematic of FoxTTL 2-meter transmitter.

capacitors and three RF chokes, the fundamental (48.3 MHz) and the second harmonic are suppressed, and the third harmonic, on 144.900 MHz, remains intact. Power output ends up being around five to 15 milliwatts, depending on battery voltage. The beacon consumes about 35 mA, and you can expect about 10 hours of battery life when using a nine-volt alkaline battery.

The audio oscillator section is created using a 555 timer. The configuration of the audio oscillator, by brute force, "pulls" the transmitter, causing the tones to frequency-modulate the transmitter. Aside from not staying within engineering convention on the manner in which the oscillator is configured, this design "goes outside the box" by utilizing a flashing LED as a means to cause the audio oscillator circuit to decay. The resultant tones that are created can be varied by audio frequency and cadence, with a single potentiometer. Nope, I have never seen an LED employed in this manner. By bridging the LED, an 1800 Hz tone is created and an additional IDer circuit can add an ID tone to the device by simply shorting out the flashing LED

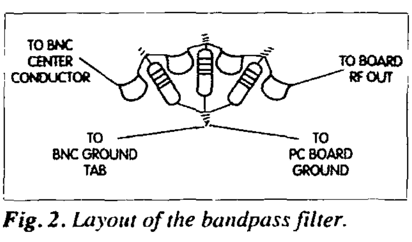


Fig. 2. Layout of the bandpass filter.

leads. This approach further reduces the overall parts count. You've seen it here first: If it works, don't knock it!

Construction

Point-to-point soldering on a small perfboard will work with this project, although I have found that deviation levels are affected, depending on parts placement and lead length. (Boards and parts available: See end of article.) The high-pass filter, consisting of four capacitors and three chokes, is not part of the PC board layout. The transmitter will function without it; however, good engineering practice requires this filter to be employed in the design. See **Fig. 2** for the layout of the high-pass filter. I built the filter separately and kept all lead lengths to an absolute minimum. The resultant "mini circuit" is bridged between the PC board and BNC connector.

Remember to observe the polarity of the flashing LED. The long lead is the positive side of the component.

The 0.1 µF disc capacitor (marked 104) (see **Sources**, below) used in this project was, oddly, the only component critical to the FoxTTL's proper operation. Substitutions of similar-value capacitors of different manufacture produced mixed results, probably due to inductance (not capacitance) that was critical to the circuit's operation. The cadence and tone adjustment potentiometer worked best with the selected disc

Continued on page 12

Photo A. You can have it this way, or this way ...

Build the FoxTTL

continued from page 11

capacitor. Later substitutions of this component caused needless hours of head-scratching!

After assembling the high-pass filter and circuit board, I decided to go ahead and "pot" the circuit using automotive Fiberglas™ resin. Pot the circuit in Fiberglas resin? Think of it this way: You may have seen or heard about insects becoming entrapped in some tree sap that eventually turned into amber. Funny thing is, those insects look like they got stuck only yesterday, yet carbon dating indicates that they became entombed, in some cases, over 10 million years ago. Carry this idea over to protecting a circuit—and who knows? Maybe 50,000 years from now someone will power one of these circuits up and the procedure may create a new form of archeology called "fossil electronics." All joking aside, this technique will ensure that the circuit really will be indestructible in the worst possible conditions. By mixing the Fiberglas resin with a catalyst, you'll have the material hardening in about half an hour. If you elect to pot your circuit, make sure you conduct this procedure out-of-doors as the fumes will spontaneously cause you to start agreeing with everything that Wayne Green writes. Also, make sure that it is at least 70° Fahrenheit when you mix the material, as cooler temperatures will slow down the curing process. It's imperative you follow the directions listed on the Fiberglas resin container, due to the caustic nature of the material. By adding a little acrylic pigment (about 10 drops per ounce of resin) you can make the completed package look like a commercially manufactured product.

I also elected to bring out the LED in a position such that the potting material would leave it partially uncovered. The flashing LED serves a dual purpose: first, as an indication that the battery and circuit are working; and second, as a means of creating an unusual beacon tone. Also, be aware that Fiberglas resin has a tendency to infiltrate switches and potentiometers prior to curing. When in doubt, cover these components with a little bit of modeling clay to prevent any Fiberglas intrusion on possible entry points.

If your circuit board is mounted in the metal enclosure available from Midwest Surplus (see **Sources**), make sure that it does not come in contact with the side walls of the enclosure. This can be accomplished by taping the interior portion of the enclosure. As the tape is not visible once the Fiberglas is poured in, this is the best means to ensure that shorts do not develop prior to the Fiberglas setting up.

Operation

When the transmitter is powered up, adjust the potentiometer for the desired cadence/tone. As a side note, when the flashing LED is exposed to bright sunlight, internal resistance changes within the LED and this may speed up the cadence of the tone—something to keep in mind if the LED is facing the sun on a partly cloudy day.

FAR Circuits has made available prepared circuit boards (etched, drilled and silk-screened). The boards are made of G-10, FR 4 material, 1 oz. copper, solder-coated, and drilled. Included is an LC network (capacitor/coil form combination) etched on this board, but that is not utilized for this particular circuit layout. See **Sources** below if you are interested in building the project using the available circuit board.

Sources

FAR Circuits
18N 640 Field Court
Dundee IL 60118
[http:www.el.ais.net/farcir/]

The circuit boards are $4.25 each, plus $1.50 shipping and handling *per order*. Orders are accepted only by surface mail or FAX. No orders will be accepted via E-mail. All orders must be prepaid by check or money order, VISA or MasterCard. Credit card orders will include a $3.00 service charge and may be FAXed to (847) 836-9148. To order, please indicate the "ship to" address, home phone number, quantity of boards, magazine and month the article appeared.

All parts for this project, excluding circuit board, antenna and battery, can be ordered as a kit for $20.00 from

Midwest Surplus Electronics
P.O. Box 607

Continued on page 20

Parts List

Qty.	Description
4	.15 µH choke
1	2.2 µF 50 V electrolytic capacitor
1	0.1 µF 100 V axial capacitor
1	0.1 µF disc capacitor
2	5 pF disc capacitor
2	18 pF disc capacitor
1	10 k potentiometer
1	10 k 1/4 W resistor
1	9 V battery
1	9 V battery connector
1	SPST switch
1	BNC connector (chassis mount)
1	BNC Protecto-cap
1	battery holder
7	screws & mounting nuts
1	collet type potentiometer knob
1	PC Board
1	TTL clock oscillator (48.3 MHz fundamental)
1	555 timer
1	blinking LED

Table 1. Parts list.

The Evolution of Power Supplies

Part 1: dynamotors and vibrators.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

If you've been around ham radio very long you've seen a number of power supply types, but are you aware of how they've changed over the years? What is referred to as a "power supply" is the interface between the ordinary wall plug and a radio, or between an automobile battery and a radio. The evolution of the interface device has seen a great many changes over the past 60 years. Reviewing the various common types raises feelings of nostalgia for some hams, while for others it is an educational step through historical memorabilia.

Latecomers to ham radio are familiar with radios that require a 12-volt power supply, because most radios today are of a solid state design that operates directly off an automobile battery. However, prior to semiconductors, almost all electronic equipment used vacuum tubes—which required a much higher voltage than most semiconductors.

Throughout the history of radio, power supplies have been available that obtain power from commercial power mains, and we think of that power as being typically 120 VAC which must be stepped up or down in voltage level to meet the radio's requirements. The change in voltage level has been provided by a power transformer (**Fig. 1**), of which there are many variations in the rectifier and filtering circuits. A DC voltage is obtained by rectifying the AC output from the transformer and, for vacuum tubes, an AC voltage was also provided to the heaters.

AC power supplies have gone through a transition from heavy iron transformers to powdered iron switching circuits, but power supplies for mobile radio applications have had an even greater evolution. To show the various steps in the evolution, we will discuss some of the more popular mobile supplies, starting here in Part 1 with the dynamotor and vibrator versions. Part 2 will pick up with switching power supplies of the types used in mobile and home computer applications.

Dynamotor

The dynamotor power supply was developed during the late 1920s and early 1930s for use in automobile car radios. An outline of one is shown in **Fig. 2.** At the time, they were called rotary converters (also called rotary transformers), with many applications both inside and outside of automobile radios. During World War II, dynamotors were produced in huge quantities for military applications, and following the war many dynamotors became available to hams through the surplus market.

Perhaps one of the most famous dynamotors was called the PE-103. It was capable of being operated from either a six- or 12-volt car battery. The output voltage was 300 VDC (600 V output if 12 V was applied to the 6 V input) which made it ideal for mobile ham transmitters. Another feature of the PE-103 was that it could be remotely turned on and off. This made it more convenient to use, particularly during short transmission periods after which it would be turned off. The armature inertia was a little troublesome during a push-to-talk situation because

Continued on page 14

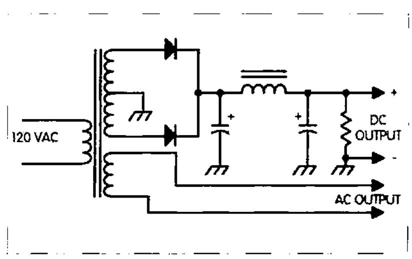


Fig. 1. Typical AC-powered supply.

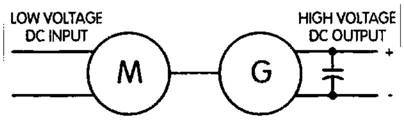


Fig. 2. Typical dynamotor or rotary transformer.

The Evolution of Power Supplies

continued from page 13

the output voltage would neither rise nor drop off rapidly.

A dynamotor is, in essence, a motor-driven generator with the motor being powered by a DC voltage. Being motor-driven, the generator operates like a rotary transformer in which the magnetic lines of force created in the field windings cut the armature wires, causing a voltage to be developed across the armature winding. The voltage developed across the armature is AC, but a DC voltage will be obtained at the output because a commutator is used. An AC voltage could be obtained from the armature if slip rings were used instead of the commutator. If used that way, it would be called an inverter, but for use with radio a DC voltage is required, so a commutator is used.

The commutator and brushes provide the equivalent of a mechanical rectifier. Because the brushes had a tendency to spark, noise was introduced into the DC output, requiring filtering in a manner similar to that used in a modern AC-powered DC supply. One of the phenomenal things about the dynamotor was that it was extremely reliable; it would take a lot of punishment and continue to operate. Those dynamotors that haven't become part of the local landfill would still operate reliably today.

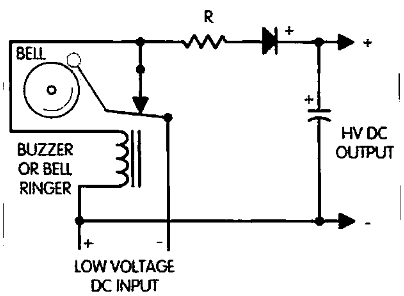


Fig. 3. Buzzer or bell ringer power supply. DC output obtained from rectified flyback voltage.

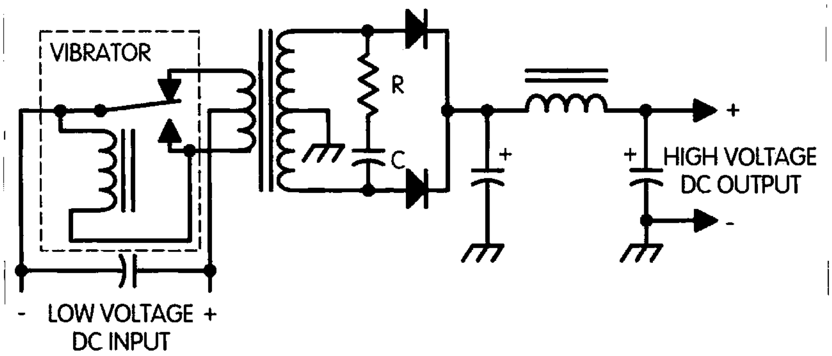


Fig. 4. Vibrator power supply used in early car radios. Typical rectifier was an 0Z4, 6X5, or 6X4 tube.

Vibrator

Vibrator power supplies were developed in parallel with the dynamotor, with the objective of reducing the amount of weight and the size, and improving the efficiency of the power conversion process. Where a dynamotor might have a power conversion efficiency in the range of 25–40%, the vibrator supply could achieve 60–70%.

Vibrator power supplies were used in car radios well up into the late 1960s, when high perveance, low voltage tubes became popular. These tubes operated directly off the 12-volt battery, as semiconductors do today. A high voltage was not required.

The transition to solid state occurring during the 1960s reduced the use of low voltage tubes. However, hams still use high voltage tubes in some mobile applications, so high-voltage power conversion equipment is still required. Today, though, the power is obtained from a switching power supply instead of from either a dynamotor or vibrator supply.

The earliest vibrator supply began as a development from a buzzer circuit as shown in **Fig. 3**, where the high voltage flyback from the coil was rectified and used as DC power. The efficiency of the buzzer supply was perhaps in the 5–15% range, and any significant load would "kill" the buzzer action and shut down the supply. However, the concept of DC–DC power conversion was clearly demonstrated.

Vibrator power supplies operate in a manner similar to a buzzer, in that the DC input is chopped by the vibrator contacts to create a pulsating DC current flow in the primary winding of the transformer. Later model vibrator supplies, as shown in **Fig. 4**, operated from a six- or 12-volt system (with some World War II military and aircraft vibrator supplies being operated from 24-volt systems).

In operation, the transformer must transfer power from the primary winding to the secondary. For that to happen, the current flow in the primary must be continuously changing in magnitude. The changing current creates a changing magnetic field around the primary winding, where the moving lines of force will cut the wires of the secondary winding and cause a voltage to be developed across it.

At this point, the process is exactly the same as that which occurs in a transformer being operated from an AC source such as a wall outlet. However, the waveform caused by the vibrator is closer to that of a square wave than that of a sine wave as obtained from the wall socket.

Once a voltage was developed across the secondary winding, it could be rectified to produce a DC voltage in the same manner as that of an AC-powered supply. Because of the abrupt opening and closing of the vibrator contacts which produced the square

Continued on page 33

Surface Mount SW RF Booster

Easy-to-build design, plus high-pass filter to boot.

Homer L. Davidson
1517 First Avenue North
Ft. Dodge IA 50501

Every shortwave listener knows that most shortwave reception seems to fade out during the daytime and become greater during the nighttime or early morning hours. Sometimes those hard-to-get and far distant stations can only be heard for a few minutes, then out she goes! You might live where a long antenna cannot be erected and only a short length antenna must do. Here is where the SMD RF booster comes into the picture.

The untuned SMD booster can help pick up those weak shortwave stations at all times. This booster amp works best on small two- or three-transistor or IC shortwave receivers that may lack gain and selectivity. When the SMD booster is connected to a regenerative SW receiver, it prevents oscillations from feeding back into the antenna and helps boost the shortwave reception (**Photo A**).

The surface mounted booster was constructed of tiny electronic components, which take up only a small space inside the receiver cabinet. In fact, you can mount the booster amp just about any place inside or outside the receiver. Simply spot the small 1-1/4- x 2-inch chassis with epoxy or silicone cement on the rear panel next to the outside antenna jack. This small booster can operate from an inside or outside 4.5 to 9 V power source.

Besides a two-stage RF booster, a high-pass filter network is found between Q1 and Q2. Sometimes, when listening to the 80 or 160 meter band, a local broadcast station might break through, especially on home-built shortwave receivers. The NPO capacitors, C2, C3, and C4, with L1 and L2, form a high-pass filter network to eliminate that high-powered local broadcast station between 500 and 1750 kHz. This high-pass network has a 50 Ω input and output impedance.

Circuit operation

The surface mounted (SMD) components are found in the untuned booster stage that can amplify RF frequencies from the broadcast band (500 kHz) to 5 MHz. There are no tuned coils in the front end of the RF booster. There are two general purpose SMD transistors (NPN) that operate in series untuned circuits (**Fig. 1**). The outside antenna wire plugs into or connects to J1, and the output of J2 connects to the antenna jack of the shortwave receiver. The input and output booster wires can be inserted in series with the outside antenna jack of the shortwave receiver.

A high-pass filter network was installed between Q1 and Q2 to keep strong broadcast stations from being amplified, especially within the 80 and 160 meter bands. Capacitors C2, C3, and C4, with L1 and L2 (3.3 μH inductance), form a high-pass filter network. The high-pass filter works best on home-constructed shortwave receivers that do not have the gain and selectivity of a commercial SW receiver. If the RF booster overloads the signal on a few stations, a 1 kΩ control can be installed at the antenna circuit of the receiver to attenuate the incoming signal.

Be careful out there

Remember, these SMD components are tiny in size and must be handled with care. The SMD part is so constructed that solder is applied to each end, which lies upon a solder pad of the PC wiring. Q1 and Q2 are so small that a magnifying glass should be used to solder in the three terminal connections. Too much heat can destroy these SMD transistors. Keep the B+ source below nine volts so as not to damage the electrolytic capacitor. Choose a

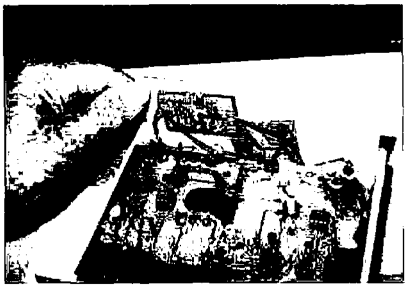


Photo A. *The small RF booster can be mounted on the back panel near the shortwave receiver antenna jack.*

16-volt working voltage electrolytic (C7) so that it will not run warm or break down and short out the voltage source.

Since these SMD parts are so tiny, they can easily be lost or flipped out of sight. Take one component out of the plastic package at a time. Put the other parts back in the package. Place the part upon a white sheet of paper before installation, and measure for correct resistance and capacitor leakage with the 2 kΩ range of an ohmmeter. Place the ohmmeter probe tips at each end of the resistor or capacitor for a correct test. Likewise, check each SMD transistor on the "diode test" of a digital multimeter (DMM), if one is available. How to test transistors with the diode test is explained later in this article.

Grasp the tiny component with a pair of eyebrow tweezers and hold the soldered end over the correct soldering pads. Choose a small-diameter-type solder for those tiny connections. Apply the solder on one pad terminal. Butt the part end up to the pad and solder up. Now solder up the other end with the fine point of a soldering iron. Double-check the soldered connections with a magnifying glass.

The most difficult SMD components to solder into the circuits are the NPN transistors—they have such tiny connections. Try to center the three terminals over the right soldered tabs, with the tweezers. Place a small amount of solder on each pad. Solder in one terminal to hold it into position. Then solder up the other two connections with the fine point of your soldering iron.

Check between each element with the 200 Ω range of the DMM for leakage. Make an in-circuit diode-transistor test of each transistor: You'll want to make sure the transistor was not damaged while you were soldering the connections. The resistance and diode test of transistors, resistors, and capacitors checks parts for damage and that the correct part is at the right location. This ensures that the RF booster will perform after all the parts are mounted.

Choose a 25- or 30-watt battery-type soldering iron to solder up the SMD connections (**Photo B**). If necessary, file down the iron tip to a fine point. Likewise, grind the ohmmeter test probes down to fine points for easy and safe testing. Do not leave the soldering iron on each transistor pad too long, to prevent possible heat damage.

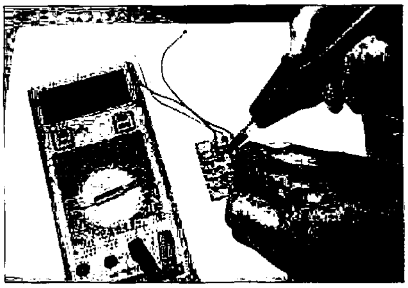


Photo B. *The battery iron is ideal to make soldered connections on the ends of the SMD parts.*

Turn the black side of the SMD resistors upward. You might find a number or resistance value marked on top. Here, a magnifying glass does the job. Most flat-type electrolytic capacitors have the capacity and working voltage stamped on the top side. The white line of C7 (47 µF) should be placed on the positive side of the voltage source. If you use a metal-type SMD electrolytic capacitor, place the black side to the common ground connection. Check the mounted electrolytic capacitor on the 2 kΩ range of the DMM. The electrolytic capacitor should charge and discharge by reversing the test probes, indicating a good connection and normal capacitor, and no shorts or leakage.

Construction

All of the SMD components are mounted upon a 1-1/4- x 2-inch PC board. Simply cut out a piece from a larger copperclad PC board. Clean off the board with an SOS® pad or soap and water. Lay out the PC wiring as shown in **Fig. 2**. Use the dry etched transfer pads for the mounting pads of the small SMD parts. Two IC transfer pads can be used for the base and emitter terminal connections. Then, place one IC pad in the center and above for the collector terminal. Notice that the two SMD transistors are mounted in the center of the board.

The transfer pads are tied together with pieces of transfer lines to form the various circuits. The input and output dots are placed at each end of the

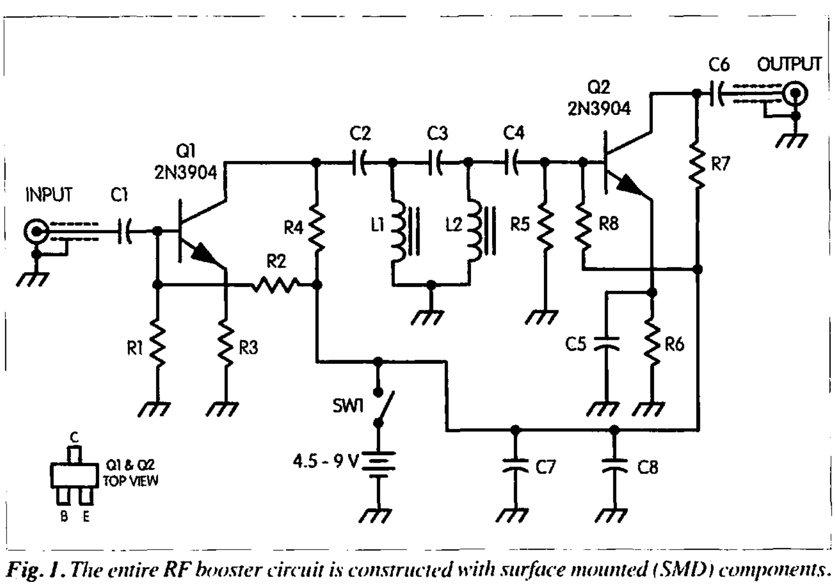


Fig. 1. *The entire RF booster circuit is constructed with surface mounted (SMD) components.*

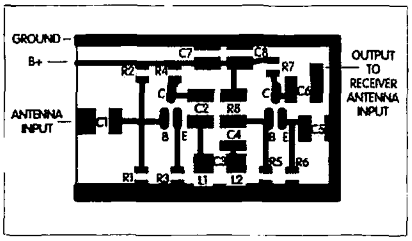


Fig. 2. The part tabs and wiring layout on a 1-1/4- x 2-inch PC board.

board. Place a larger dry transfer line around the outside edge of the PC board for a common ground.

After laying out the PC wiring, the small board can be etched in less than 35 minutes. Remove the PC dry transfer lines, after the board has been etched, with a kitchen scrubbing pad. Clean up and wash off the entire PC board. Double-check each pad and wiring for cracked or bridged connections. If one pad touches another, cut out the excess with a razor blade or craft knife. Tin each pad with solder as the parts are mounted.

Start mounting the SMD components by soldering in each resistor. Before mounting, check the value of the resistor with the ohmmeter. Then, check the resistance once again after the SMD resistor is soldered into position. Check the soldered connection with a magnifying glass. Next, mount all the bypass and coupling capacitors (**Photo C**). Since these capacitors do not have a ground identification line, it does not matter which end is soldered in. Of course, you must observe the correct polarity of an electrolytic capacitor (C7). Now check across each mounted capacitor for possible leakage with the 2 kΩ range of your DMM.

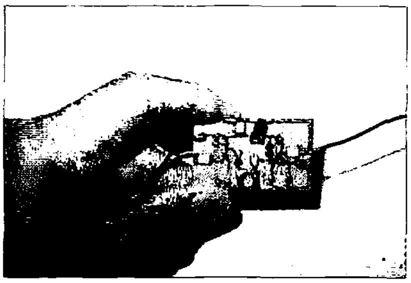


***Photo C.** A close-up view of the miniature SMD components of the booster amp and high-pass filter network.*

Mount L1 and L2, and Q1 and Q2 after all other SMD parts are soldered into the circuit. Check across L1 and L2 after they are soldered in for low-ohm continuity. Test each transistor with the diode test of the DMM. Place the red (positive) probe of an NPN transistor at the base (B) terminal and the black (negative) probe at the collector (C) terminal. You should have a normal diode junction test resistance, somewhere between 700 to 850 ohms, depending on your DMM. Leave the red probe at the base (B) terminal and place the black probe at the emitter (E) terminal. This normal resistance measurement will be within a few ohms higher than the collector measurement or the previous test.

Now reverse the test leads. A normal infinite resistance measurement indicates a good transistor. If a low-ohm measurement below 100 ohms is noted between any two elements, even with reversed test leads, the transistor is leaky. A low resistance measurement (less than 5 Ω) means that the transistor is shorted. The shorted or leaky transistor will have a low-ohm leakage with reversed test leads in both directions. Replace the transistor.

Connecting up

Double-check all soldered connections with a magnifying glass. Solder a 9 V socket harness to the common ground and B+ terminal tabs of the PC board. Connect a short input hookup wire to input terminal C1 and a flexible wire to output terminal C6. Solder a ground wire to the common PC wiring that goes around the outside of PC board. The booster amp is ready for testing.

Testing

Check out the RF booster before mounting inside the shortwave receiver cabinet. Connect the outside antenna jack to the input cable of the booster amp. Temporarily, clip the output terminal wire to the receiver antenna jack. Insert the 9 V battery. Now tune in a weak station.

Quickly, remove the outside antenna wire from the input of the booster and apply it to the SW receiver antenna

jack. Notice the gain of the RF booster. Now, reconnect the RF amp and notice the difference in reception. The signal strength of the RF booster is really noticed on the regenerative, conversion, or low-cost superhet SW receiver. You can now hear stations that were not tuned in before. Or at least you can hear them for a longer period of time.

Suspect a defective component or a misplaced SMD part if the SW booster does not operate or has no output signal. Take a current measurement with the milliamperes meter probes in series with the B+ voltage source. The normal current should be around 6.7 mA. Take a resistance measurement across the 9 V socket with the battery removed. The normal resistance should be above 4 kΩ. If the resistance is lower, suspect a leaky transistor or capacitor C7.

Take critical voltage measurements upon each transistor terminal and compare to the schematic. It is best to take the voltage measurements at the PC wiring of each transistor terminal, to prevent damage to the transistor. Test each transistor with the diode test of the DMM (**Photo D**). Check each transistor for leakage between each terminal on the 2 kΩ range of your ohmmeter. Suspect a leaky transistor or electrolytic capacitor with a high current measurement and a low DC voltage source.

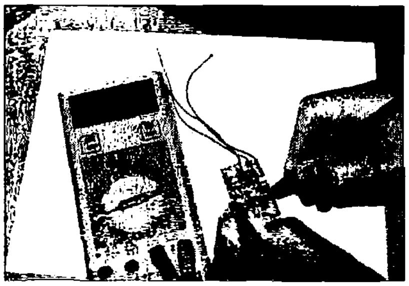


Photo D. Check each SMD transistor on the "diode-test" of the digital multimeter (DMM).

By checking each component with a resistance measurement before and after it is soldered into the circuit, you know the RF amp will perform when the project is completed. Be very careful when soldering all SMD components. Do not apply too much solder or heat from the soldering iron on the tiny transistor terminals. Check each soldered connection with the magnifying glass. This small SMD booster amp can provide better SW reception, can be mounted just about any place, and can operate from a separate battery or from the SW receiver power source. Have fun!

Parts List

C1, C5, C6, C8	0.1 µF 50 V NPO ceramic
C2, C3	0.001 pF 50 V NPO ceramic
C4	0.002 pF 20 V NPO ceramic
C7	47 µF 16 V electrolytic
L1, L2	3.3 µH coils *DN10332CT-ND
Q1, Q2	2N3904 *FMMT3904CT-ND
R1, R2, R8	5.6 kΩ 1/8 W
R3, R4, R5, R6, R7	1 kΩ 1/8 W

Miscellaneous Parts: 1-1/4 x 2 inch PC board; solder; hookup wire; etc.

*Digi-Key part number

Table 1. Parts list.

Build the FoxTTL

continued from page 12

501 West Main Street
Fairborn OH 45324
(800) 523-3690
(No minimum order)

When non-hams see the FoxTTL, I answer inquiries by explaining to them that foxhunting is like trying to find electronic Easter eggs ... but this kind of game becomes serious once the skills are developed and the team is hot on the trail of a lost balloon payload or even a downed plane—it's a skill that just might save a life!

VHF/UHF Signal Source

There's always room for another piece of test equipment!

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

As hams, we get involved with projects requiring test equipment beyond what we could normally afford or have available. Recently, I was in need of a stable signal source for evaluating and tuning several repeater receivers operating in the 450 MHz band.

After using commercial tunable signal generators, it became apparent that a crystal-controlled signal source was needed to maintain signal stability during critical tuning steps which involved only a single frequency. The problem encountered with the commercial signal generators available to me was that they continued to drift in frequency even after a long warm-up period. In my situation, frequency stability was far more important than frequency accuracy, although very desirable.

Fortunately for me, a Motorola Motrac channel element became available. The channel element is a crystal-controlled Colpitts oscillator designed as a plug-in unit. It uses a fundamental crystal operating within the range of 6–18 MHz. Channel elements are temperature stabilized, with thermistors controlling a varactor across the crystal.

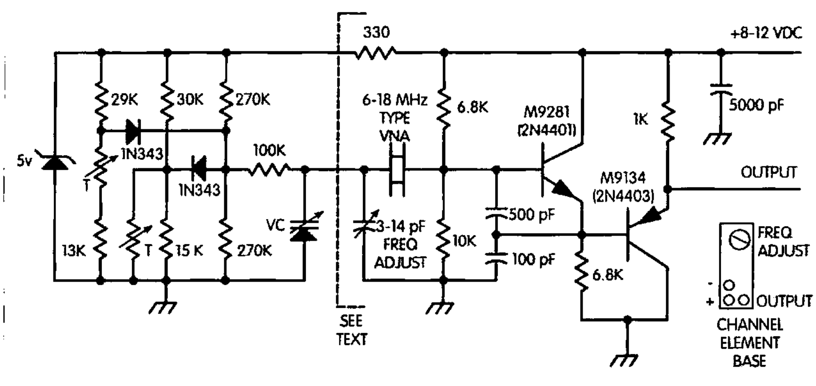


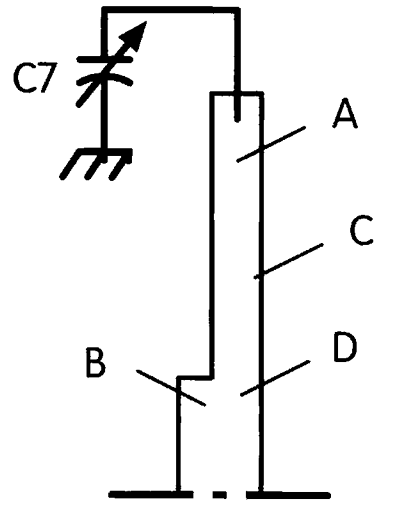
Fig. 1. Motorola TLN 1086/87 channel element.

Motorola made two versions of the channel element: one for the receiver and one for the transmitter. The circuit design is slightly different for each, and I'm not sure which version it is that I used, but the schematic is approximately as shown in **Fig. 1**.

The use of a Motorola channel element is really an "overkill" situation for a VHF/UHF signal source project. A Colpitts oscillator and buffer without the frequency stabilizer would be a better choice in this specific application. The section shown to the right of the dotted line in **Fig. 1** is all that's really required for the project. However, I chose to use the channel element as is, without modification—with some conflicting results which will be discussed later.

My channel element came with a 12 MHz crystal. I needed a signal at 450 MHz. I considered several alternatives to obtain the frequency multiplication from the 12 MHz source. Some of the alternatives involved building up a series of transistorized multiplier stages with an output on 450 MHz, using a monolithic amplifier driving a 450 MHz resonator, or using a crystal diode multiplier

Continued on page 22



Element	Freq. Band	
	450 MHz	144–220 MHz
A Resonator	2 1/4 x 1/8"	6 1/4 x 1/8"
B Link	1/2 x 1/8"	1 1/2 x 1/8"
C Spacing	1/16"	1/16"
D Diode Tap	1/2"	1 1/2"
C7	4–18 pF	5–20 pF

Fig. 2. *Stripline dimensions and lengths for different frequency bands.*

VHF/UHF Signal Source

continued from page 21

driving a 450 MHz resonator. The latter was chosen after reviewing the criteria involved.

The criteria for selecting the multiplier technique involve the desired signal level required at the receiver input. amplitude control, stability, and a signal at an output impedance of approximately 50 Ω in order to drive a length of coax. Signal leakage directly from the signal source was a critical factor when tuning sensitive receivers. Typically. the signal level required is between 0.1 and 2 µV at 50 Ω. Yes, it is desirable to have a variable signal level for evaluating the sensitivity of the receiver and for comparing the sensitivity of one receiver to that of another.

As indicated for my signal source, I chose the crystal diode multiplier driving a stripline resonator operating at 450 MHz. The resulting combination was an excellent choice as a source for my receiver tuneup needs.

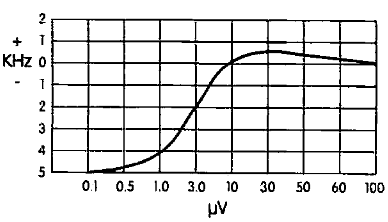


Fig. 3. *Frequency shift relative to output voltage setting.*

Multiplier theory

Before proceeding with the signal source project, perhaps it's desirable to review how a diode can be used as a frequency multiplier. Frequency multipliers operate on the principle of creating distortion of a fundamental (originating) signal. The resulting distortion can be translated into frequency multiples of the fundamental where the shape of the resulting waveform provides an indication of the harmonic content. Examining specific identifiable waveforms provides the necessary insight into frequency multipliers. Because of their predictability, specific waveforms such as sine, square and triangular will be discussed.

A sine wave is a signal waveform having a smooth transition from one voltage level to another. A pure sine wave with its smooth transitions contains no distortion or abrupt changes. and therefore contains no harmonic energy—only the fundamental signal exists.

However, when a square wave is considered, you can observe the abrupt vertical to horizontal transitions. The flat horizontal portion might be considered to be a DC value (low frequency component) that lasts for a short moment in time. The vertical transition between the upper and lower flat portions is rise time (high frequency component) that is usually measured in transition time (i.e., ms, µs, ns).

A square wave is the result of combining a fundamental signal with an infinite number of odd harmonics of the fundamental. The fundamental is also its own first harmonic. A pure or perfect square wave would contain only odd harmonic frequencies of the fundamental with all of the even harmonics being eliminated. In reality, the amplitudes of the odd harmonics are more predominant than those of the even harmonics, but some even harmonic energy remains in a square wave.

Different from both the sine wave and square wave is a triangular waveform that has an appearance similar to a sine wave and a sawtooth. However, the triangular waveform is unique in that the rising and falling transitions are symmetrical with equally linear ramps from one voltage level to another. There is no hesitation or flat spot as with a square wave and no smooth rolling transitions as exhibited by a sine wave. A triangular wave is the result of combining an infinite number of even harmonics from a fundamental, but the fundamental, being an odd harmonic, is not present in the waveform. Like a typical square wave, a triangular wave will exhibit a predominance of even harmonic energy, but it will contain some odd harmonic energy as well.

For a frequency multiplier to work properly, it must have signal energy available at the desired harmonic of the fundamental. Since very few generated waveforms are really pure, they will contain some harmonic energy at many whole-number multiples (i.e., 2, 3, 4, 5, 6, etc.) of the fundamental. In the case of this VHF/UHF signal source project, the 36th multiple of 12 MHz was required to deliver signal energy at 450 MHz. To ensure the presence of harmonic energy in a signal, it is necessary to distort the waveform using any available means. In this case, a crystal diode (point contact) provided a simple and adequate amount of distortion. Because many

harmonic frequencies are present in the output, only one multiple may be of interest.

Selecting the desired harmonic signal with a resonant circuit will tend to create a sine wave signal at the desired harmonic, and the amplitude of the remaining harmonics will be attenuated, but not totally removed. **Fig. 2** provides the data for two resonators, with one covering the frequency range from about 110–225 MHz and the other covering 420–450 MHz. Adjusting the length of the resonator to accommodate a higher or lower band of frequencies is fairly easy. To go higher in frequency, assuming that the resonator is too long, a jumper wire may be soldered horizontally across from ground, to "B", to "A", to ground on the opposite side. The height of the wire short determines the basic frequency of the resonator. To go lower in frequency, assuming that the resonator is too short, is a little more difficult to correct, but is accomplished by increasing the lengths of the "B" and "A" elements by removing copper at the bottom of the slots. Increasing the length of the resonator lowers the resonant frequency.

Signal source project

Most signal generators control the signal output amplitude by using a precision voltage divider. Such a divider is a little difficult to implement in an amateur-built project, so an alternative method was selected. To accomplish a variable output amplitude level control, I chose to vary the supply voltage to the channel element, which worked well in my application.

However, varying the supply voltage on a varactor-controlled oscillator is not without consequence, as shown in **Fig. 3**. The curve shows a shift in frequency as a function of microvolt output, which is caused primarily by the increase in varactor capacitance as the power supply voltage is decreased. This effect is observed primarily at voltages where the internal zener begins to starve. If the shift in frequency becomes an issue, then the varactor and zener control could be eliminated by removing the varactor and associated 100 k resistor as

E_{VCC} Volts	E_{OUT} µV
4.79	0
5.14	0
5.60	0.1
5.73	0.5
5.95	1.0
6.50	3.0
7.54	10
9.31	30
10.11	50
11.57	60
12.81	100

Table 1. *Relative signal output level as a function of supply voltage.*

indicated by the dotted line shown in **Fig. 1.** It will be necessary to connect a resistor with a value between 100 k and 1 meg at the varactor location to provide a DC return path to ground for the crystal.

Even without the varactor being in the circuit, I would expect a small frequency shift to remain, due to the junction capacitance changes in the oscillator transistor, but nothing as severe as that caused by the varactor. With that said, I found the signal source to be as good as expected for my application and the frequency shift was tolerable, so no modification to the channel element was performed.

Varying the oscillator supply voltage accomplished the desire for controllable output amplitude. My particular project yielded a signal output which was variable from 0 to 100 µV at 50 Ω. Perhaps one of the more difficult tasks is to calibrate the output amplitude in microvolt values. The technique that I used was to compare the signal level to that of a commercial generator. But it must be understood that the value of the actual output is in its amplitude stability and controllability, not in the actual output voltage value. **Table 1** provides a reference chart of how my signal source performed.

Fig. 4 shows the schematic diagram for the VHF/UHF signal source. An LM317 regulator provides the variable control over the oscillator's supply voltage. To achieve a somewhat vernier control of the voltage, it was necessary to adjust the ratio of the mechanical pot shaft rotation versus the output voltage.

The first step in the process was to determine the maximum and minimum supply voltage that was needed. In my case, the oscillator's output peaked at 12.5 V and ceased to oscillate at 5.5 V. The task then involved selecting the values of resistors R2 and R3 to achieve a nearly full pot rotation to cover the range from 5.5 V to 12.5 V. This expectation was almost achieved by using standard resistor values. Some patching of the R3 value could have improved the low end control, but when in use, the control was adequate.

Construction

Common parts for the project, except for the channel element, are available from many sources. There are no critical parts in the power supply section

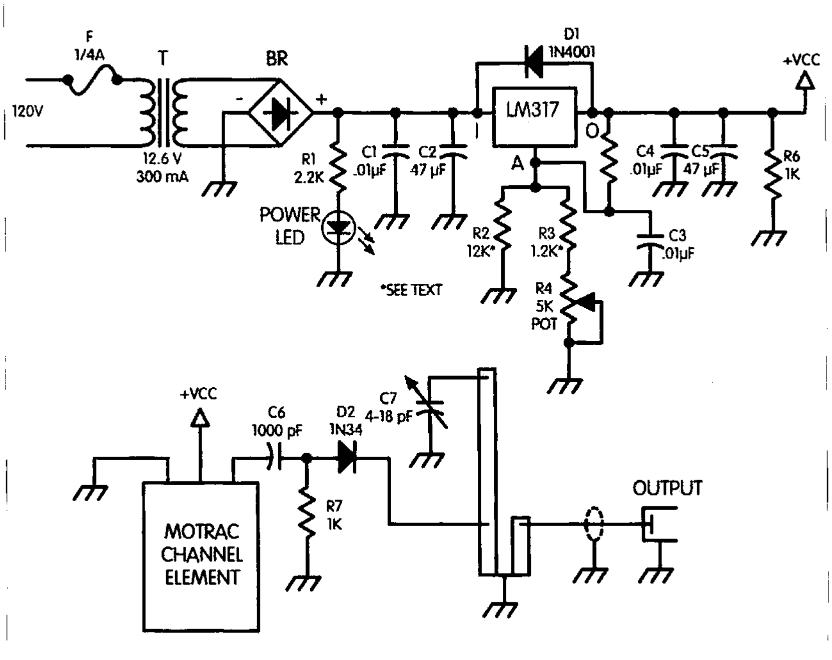


Fig. 4. *UHF signal source.*

Parts List

R (x)	1/4–1/2 W carbon resistors
R4	5 k linear pot (*RS 271-1714)
C1, C3, C4	0.01 µF disc ceramic (RS 272-131)
C2, C5	47 µF 16–35 V (RS 272-1027)
C6	1000 pF disc ceramic
C7	4–18 pF ceramic trimmer
BR	bridge rectifier (RS 276-1161)
D1	1N4001 diode (RS 276-1101)
D2	1N34 point contact diode (RS 276-1123)
Reg	LM317 voltage regulator (RS 276-1778)
F	1/4 A fuse (RS 270-1002)
T	12.6 V 300 mA (RS 273-1385)
LED	red LED (RS 276-041)

Single-sided circuit boar[illegible] any thickness

*RS = Radio Shack pan numbers

Table 2. *Parts list.*

as seen in **Table 2**. The oscillator portion may be built up from discrete parts or a channel element may be used if available. Transistors for the oscillator may be almost any device available, but I've freely substituted the 2N4401 and 2N4403 for the Motorola-part-numbered devices indicated.

Some experimentation may be required to achieve proper operation following part substitution. In any case, the signal source may be constructed to cover either the 144–225 MHz or 450 MHz band using one oscillator design and selecting the desired resonator for the band of choice.

Layout of the circuit and stripline resonator is not critical as long as the stripline is mechanically close to the oscillator's output and is kept free of dangling wires. I constructed my project on a piece of single-sided circuit board with copper on the top side so that I could see the resonator. Yes, the resonator could be on the underside of the board as long as the board is supported a minimum of one-quarter-inch from a metal surface.

Although it is my usual practice to etch circuit boards, for this project I used a dental burr to rout out the resonator and circuit pads for the power supply. The final results are the same, but the appearance of the routed board isn't quite as nice. When using the routing technique it is necessary only to isolate a copper pad from the rest of the copper plane. The pad is used as a tie point for a component lead. When completed, the finished board appears to remain intact but has small islands for attaching component leads. Long traces can be routed as well, to save placing jumpers on the board.

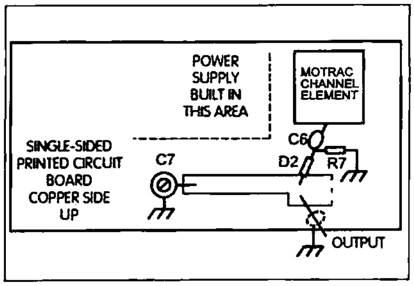


Fig. 5. Circuit board and stripline.

Following completion of the mechanical construction, it is necessary to test and adjust the device. The first step is to use an ohmmeter to check various component pads and traces to make sure there are no shorts to the copper ground plane. The second step is to apply power, assuming that all components are properly oriented, and verify variable control of the oscillator's supply voltage. Set the voltage control to approximately 12–13 V.

With a receiver tuned to the frequency desired from the signal source, adjust the frequency set capacitor for center channel. Then adjust the capacitor C7 for maximum signal amplitude into the receiver. It may be necessary to lower the signal amplitude to "observe" a peak setting of C7.

Upon completion of the tuneup operation, the signal source is ready to use. Vary the output amplitude control and observe the pot position for a minimum detectable signal. You might expect that amplitude to be in the range of 0.1–0.5 µV when using a recent-model ham mobile transceiver. As I did, you'll gain a "feel" for the relative sensitivity of one receiver versus another after using the signal source a few times.

Even though this VHF/UHF signal source project is simple and noncritical to build, it does add a needed dimension to your inventory of test equipment.

73 Review

Number 26 on your Feedback card

Hamtronics' R301 Synthesized VHF Receiver

For foxhunting, even ...

Larry Antonuk WB9RRT
P.O. Box 452
Marlborough NH 03455

Our local ham club, bitten by the foxhunting bug, had a hunt the last Sunday of each month. I had been teaming up with a couple of my buddies, and the three of us were having a great time honing our foxhunting techniques and tweaking our equipment. We'd constructed several different antenna setups for on-foot and vehicular tracking. After the first few hunts, however, we had to acknowledge a major deficiency in our foxhunting tools. We were using lousy receivers.

When a transceiver just isn't good enough

Actually, the receivers we had weren't what you would normally consider lousy. They were practically top-of-the-line handhelds, manufactured by a couple of the leading ham radio manufacturers. They had more bells and whistles than we knew what to do with. The problem was, they just weren't suitable for serious foxhunting, because of their lack of shielding and poor selectivity.

For example, one of the hunts went quite well until the final half-mile. Once we closed in on the fox it became impossible to get a clear bearing. It seemed like the fox was all over the place. As it turned out, the fox had been hidden in the vicinity of a commercial FM broadcast tower. The FM station simply overloaded the front ends of our little handhelds, since they had little or nothing in the way of front-end selectivity, and slightly less than average IF selectivity. (This situation turned out to be more of a fortunate mistake by the fox hider than a carefully-planned smokescreen, but the result was the same.) We've had similar situations on hilltop repeater sites. There's so much RF, the poor handheld doesn't know what to do.

Another drawback to the hand-held radios was the lack of shielding. Once you get fairly close to the fox with a handheld you find that no amount of attenuation will knock down the signal. You can even disconnect the antenna and hear the fox full quieting. This occurs because the RF signal passes right into the front end of the handheld, bypassing the antenna jack. Most handhelds don't contain enough metal to melt down into a bottle cap. This fact becomes obvious when you're in the presence of a strong RF field. Some foxhunters circumvent this problem with the use of an "active attenuator" or variable mixer circuit. However, we found these to be less than desirable because they can actually retransmit the fox signal, creating a situation where the hunters are hunting each other rather than the fox. In addition, some active attenuator designs actually create signals that land outside the ham bands—not a good thing! We felt that a high-selectivity well-shielded receiver would be a better solution.

In addition to selectivity and shielding, our third requirement was fairly straightforward. One of our team was charged with the task of rotating a six-element beam in the back of the pickup as we sped down the highway. He found he had to hold his handheld in one hand in order to see the teeny bar graph signal strength display. His vote was for something with a large, easy-to-see signal strength meter.

Making the selection

Finding the radio was easier than we thought because so many choices were automatically eliminated. Our first thought was to look over all the current mobile rigs offered by the major ham manufacturers. We did this, but found that all of them were synthesized. This would be a good thing in and of itself, but in the case of mobile rigs, synthesized also meant that they had front ends as wide as a barn door. We looked into some older used commercial rigs. These were great in the shielding and selectivity department, but used crystals.

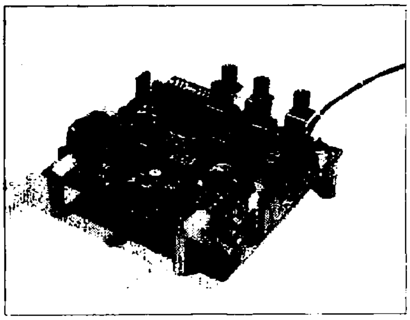


Photo A. The Hamtronics R301.

We felt that some sort of frequency agility was important. Our foxhunts all occurred on the same frequency, but what about the possibility of RDFing a jammer or lost hiker? It didn't make sense to have to switch gear when the chips were down.

One evening, as we were going over the possibilities, one of my buddies suggested Hamtronics. We had used their receiver and exciter modules in the past in some repeater applications and knew they were rock solid. My friend had heard that they now had a synthesized version of their classic R100 and R144 receivers. I thought this was great and said I'd get on the phone the next morning and get the info and catalog. My friend gave me that "did you just fall off the turnip truck?" look and led me into his ham shack. He pulled up the Hamtronics Web page, and in about a minute we were looking at a spec sheet and description of the new Hamtronics R301. (Sometimes I think I should have been born during the spark gap era.)

Checking it out

The R301 is billed as the seventh generation in the line of Hamtronics receivers. Like its predecessors, the R301 comes in several models. Four models cover segments of the range from 139.000 to 174.635 MHz, and a fifth model covers 216.000 to 226.235 MHz. (I understand that UHF versions will also be available soon! I can hardly wait!) In many ways, it's similar to the R100 and R144 receivers: about 4 x 4 inches, high quality double-sided PC board with ground plane, triple-tuned front end, and high quality crystal and ceramic IF filters. The IF selectivity is >100 dB down at ±12 kHz. It's got a 12 dB SINAD rating of 0.15 µV, and an audio power output of 1 W continuous/2 W peak (another good thing when you're in the back of a pickup at 60 mph). One thing the R301 has which the older rigs lack is an onboard computer.

Well, actually a microcontroller. The R301 uses a microcontroller to set the frequency of the receiver. Working in conjunction with a phase-lock loop synthesizer chip, the microcontroller reads the frequency programming switches and steers the PLL to the proper operating frequency. This means that the frequency can be changed by flipping a few switches (and retuning the rig if the new frequency is farther than about 1 MHz from the old frequency). The PLL is referenced to a fixed frequency standard, which is in the form of a crystal on the ±5 ppm model, and takes the form of a temperature-compensated crystal oscillator module (TXCO) on the ±2 ppm model. We didn't feel we needed the extra frequency stability of the ±2 ppm model, but the operating temperature was greater (-30° to +60° C vs. room temp ±10° C for the ±5 ppm model) so we opted for the high stability model. (Apparently it gets pretty cool in the back of that pickup truck.)

The next morning, instead of ordering a catalog, I got on the phone and ordered the R301. The UPS truck showed up two days later.

Putting it together

The Hamtronics gear ordered in the past had all come in kit form. This time, however, we went with a preassembled unit, mainly because we felt we would need to spend some time and effort getting the R301 into a suitable enclosure and building up an option or two. We felt it was important to spend as much time as possible foxhunting rather than building.

If you feel like building, however, the manual and instructions are the usual quality from Hamtronics—very clear, with plenty of troubleshooting and modification tips. The only unusual part used in the radio is a surface-mount

PLL chip. This is a 20-pin device that mounts on the underside of the PC board. (This and other magazines have published many articles on how to use SMDs. It's not a difficult process, but you may want to get some guidance if this is your first SMD project.)

Another advantage of ordering the factory-built unit is that it comes with the TXCO as standard equipment. With the kit, the TXCO is an option, which adds $40 to the cost. Once I decided to go with the TXCO option, buying the factory-built unit became even more attractive.

Frequency selection

Setting the frequency on the R301 is pretty straightforward: it is set using ten DIP switches. A jumper is also used if there is a major change in band segments. All frequencies are based on a base frequency, and each switch is weighted with a frequency value. Simply put, the base frequency plus the weight of each flipped switch equals the operating frequency. The manual gives a step-by-step description of the process.

The microcontroller on the R301 monitors the DIP switches continuously, so you don't need to reset or power down the radio to set the new frequency—it happens immediately. This would make it easy to set up different frequencies with a series of diodes and some switches, or some other remote tuning device. (So many potential modifications, so little time!)

Tuneup

Once the frequency is programmed, the receiver can be aligned to the new frequency. In most cases, the change in frequency will be less than one MHz, so retuning isn't necessary. Just change the DIP switches.

However, the sharp tuned circuits used in this design should be optimized if you want to tune farther than about one MHz from where the unit was peaked previously. This will mean only a tweaking of the VCO and the front end coils, which can be done by monitoring simple DC test points with an on-the-air signal.

Large frequency excursions will require a complete tuneup, which is only slightly more complex. Tuning requires only a sensitive voltmeter and a signal generator.

Gilding the lily

Our enhancements to the R301 were fairly simple and don't deserve much mention. We wound up mounting the unit in a cast aluminum box, supplemented with finger stock for better RF sealing of the top cover. The power, audio, and signal strength lines were fed out of the cabinet via feedthrough capacitors, inline filters, and ferrite beads. The R301 doesn't use a chip that gives an actual S-meter reading; however, a test point is available that gives a signal strength value that is based on the noise level seen in the squelch circuit. This level varies from about -0.5 to 0.75 volts. This level was passed into a circuit utilizing an LM3914 LED driver, connected to 10 high-intensity LEDs. These were mounted on a box separate from the R301's cabinet, to make it easier for the operator of the beam to set the indicator box wherever it was convenient. (Details on the receiver cabinet shielding and signal strength meter can be found in the book *Transmitter Hunting — Radio Direction Finding Simplified*, by Curlee and Moell, published by TAB Books.)

At the time of this writing, the R301 has yet to be tested under actual battlefield conditions, as the next hunt is still a few weeks away. However, preliminary tests indicate that the improved selectivity and shielding will make a marked improvement in our hunting ability. We now have a main receiver that is highly selective, is much more RF immune than anything we've used previously, and has a signal strength meter that can be read from 10 feet away. It may not propel us into the IARU ARDF World Championships, but we plan to be the team to beat in this neck of the woods.

The R301 synthesized VHF receiver is available from Hamtronics, Inc., 65-D Moul Road, Hilton NY 14468-9535. A companion T301 synthesized exciter is also available. Check out the catalog at: [www.hamtronics.com]; E-mail: [jv@hamtronics.com]; or phone (716) 392-9430 for a complete catalog. Price class: $139 kit, $209 factory-built (note: factory-built includes TCXO option).

And the (Zero) Beat Goes On . . .

More on the Fessenden Fenomenon.

Jim Fontana VE3MJF
161 Elgin Street
Ottawa, Ontario
Canada K2P 2L1
[JFont29118@aol.com]

It begins on a peaceful Sunday afternoon dedicated to building that two-meter quad I've always wanted. But in that inexplicable way that smoke sometimes starts curling out of your power supply, the tranquillity of the day unexpectedly erupts into a volcano of gastric torment.

A memory of unhappy revelations comes flooding back. It was a rite of passage, that time in our youth when we were forced to confront the unrelenting desecration of our myths and heroes.

No, Jim, there is no Santa Claus. It's all been a well-intentioned joke.

And by the way, Jim, Christopher Columbus didn't discover America, either. Chris was aced out by Leif Ericsson and his grim band of victorious Vikings some 500 years earlier.

Willy Shakespeare? He didn't really write all those wonderful plays, Jim. They actually were written by someone else with the same name.

And yes, Babe Ruth did hit all those home runs. But, if the truth be known, the fields were smaller then.

O tempora! O mores! The inhumanity of it all!

What lemming-like perversity drives us to assault our own heroes? I wonder.

But I digress.

Let's get back to the two-meter quad.

Naturally, I had resorted to my back issues of *73*, where I'd vaguely recalled having seen such a how-to article sometime in the past. I went through the pile in the garage workshop and found it in the July 1996 issue.

That's when it happened.

While riffling through the pages looking for the article, I was suddenly and cataclysmically hit again with the triple whammy, the full monty of radiodom, as it were.

It's there, on page 40. How could I have missed it just two short years ago?

"Just Who *Did* Invent Radio?" an article by Glen Zook W5UOJ asks. I sense mischief in the title.

It is more than just a title. It is a dare. A challenge. A cold, wake-up slap.

"Is there any doubt?" I ask out loud, bristling. "There is none," I reply to myself. I recoil, knowing what's coming.

Mr. Zook is out to unseat Guglielmo Marconi.

The unholy *jihad* against our heroes, the assault I thought was over, is continuing.

With quivering lip, I force myself to read—and I read it through to the end, disbelieving.

"Enough! Take that back, Mr. Zook!" I say it petulantly. I look around hoping that no one has heard me talking to myself in the quiet of the garage.

It is a short, tight article focusing more on the conclusiveness of patent litigation than hard scientific evidence. In it I am invited to believe that Marconi's claim to fame as *Numero Uno* has been displaced by a certain obscure Canadian professor by the name of Fessenden.

Fessenden. Reginald Fessenden, that is.

Now, being Canadian myself, by birth, and Italian by heritage, I'm in big trouble here. You can imagine the inner turmoil, the kaleidoscopic confusion, as one half of me tries to push the other half off the pedestal, the id and the ego slugging it out in mortal combat. It's a real king-of-the-mountain contest, a psychic dust-up.

I reach for the bottle of Maalox® on my workbench.

The Fessenden Fenomenon had always been around, but lay dormant until resurfacing again in 1966. Ormond

Raby, a Toronto writer, put out a biography detailing the professor's life.

Fessenden was born in Quebec, raised and educated in southern Ontario, and taught at the University of Western Ontario in London, Ontario, before moving to Boston where he pursued a distinguished career as a teacher and inventor.

Raby portrays Fessenden as an unrecognized genius, a *wunderkind*, who—if we are to accept even a smidgeon of what is attributed to him—makes the achievements of Marconi and his contemporaries seem puny by comparison.

Raby credits him with no less than 500 inventions, not the least of which was radio, even though it was just sort of a sideline.

Mr. Zook asserts in his article that, "By the mid-1890s, Fessenden was (already) transmitting ... from the shore to people aboard pleasure boats on the St. Lawrence River."

Now we must remember that during this time frame, while the good professor was entertaining his acquaintances in this lively manner, Marconi was still trying to jump a spark across a small room, then across a field, then between buildings. All with the help and support of some of the best brains around.

If only Marconi had heard, at the time, about Fessenden's feats, he could have saved himself a lot of wasted time thrashing about with coils, condensers, and coherers. Because, you see, by now Fessenden was already way past spark-gap primitivism. (Are you ready for this?) He was actually transmitting, not just Morse, but voice and music to those people out there on their yachts. Out on the St. Lawrence River.

It is useful to recall that in the mid-1890s, while Fessenden was purportedly entertaining his yachting friends in this manner, Sir William Preece had established himself as one of the preeminent world leaders in the field. Dividing his time between research into induction technology and managing the entire British telegraph system, he was in contact with most, if not all, the researchers of his day, in both his capacities. It is not unreasonable to assume that he was well aware of developments on both sides of the Atlantic, particularly in his position as head of the telegraph system.

Yet when the 22-year-old Marconi showed up at his London office in 1896, Preece was so impressed with what Marconi presented that he immediately threw his full support behind the young inventor, providing him with personnel, equipment, and encouragement, and arranging financing.

Meanwhile, Fessenden's accomplishments, radiowise, were, apparently, far from over.

We are told that later, on December 23, 1900, to be exact, he stunned his detractors "by successfully transmitting the sound of the human voice between two 50-foot towers on Cobb Island in the middle of the Potomac River near Washington." The towers were 1.6 kilometers apart.

Now, why he would need to demonstrate formally that he could transmit voice for about a mile when he had already performed the more spectacular feat of transmitting to his yacht-bound friends out on the St. Lawrence, we are not told.

Without meaning to sound quarrelsome, I suggest that scientific feats generally progress from the lesser to the greater, not the other way around. I learned to build a mean crystal set before I ever tackled my first QRP rig, a Heathkit H-6. But, again, I digress.

While Fessenden is performing this feat, Marconi and his supporters by now are working relentlessly on the windy rocks of Signal Hill near St.

John's, Newfoundland. They are hoping desperately to receive a few little sparks that are trying to pole-vault the Atlantic.

It is such a modest, basic goal compared to what Fessenden is already doing, isn't it? All Marconi aspires to is a simple, one-way Morse transmission.

A year would pass before Marconi succeeded, a whole year before those three raspy dots made their way through the magnetic storms, static, and ether to reach him in Newfoundland from Poldhu, Cornwall, in England.

The rest, as they say, is history.

But for Fessenden, still apparently unrecognized and unheralded, the best is yet to come.

Six years later, in 1906, with Marconi's spark-gap technology by now quite well developed and in place, and the airwaves fairly crackling with primitive Morse messages, The Great Fessenden performs his most outstanding feat.

Are you sitting down?

On Christmas Eve, 1906, we are told, he broadcast voice and music to ships in the Caribbean from his station at Brant Rock, Massachusetts. The banana fleet ships of the United Fruit Company were treated that night to the professor playing "Silent Night" on his violin, as well as recorded music.

They were separated by 1600 kilometers.

Now that beats poor old Marconi's pitiful dots and dashes, doesn't it?

Yet another account of the same event says that Fessenden "delighted listeners up and down the East Coast by broadcasting voice and music from his transmitter at Brant Rock using a high-frequency alternator based on Tesla's designs and principles."

The first account, no doubt recognizing that there is a slight *non sequitur* problem here with the receivers, allows that the ships must have had Fessenden's special receivers installed in them. The other version leaves us to wonder what receivers those people up and down the East Coast were using.

Presumably, receivers capable of receiving the professor's voice and music were not in general usage up and down the East Coast. But that could be

because they hadn't been invented yet. Unless, of course, the professor had gone around like Johnny Appleseed, distributing and installing his them up and down the East Coast of the United States.

This version also suggests that the voice and music were being received over the relatively primitive spark-gap equipment.

"Radio operators on ships in the Atlantic were shocked to hear a human voice emitting from the equipment they used to receive Morse code. Many operators called their captains to the radio room where they heard Fessenden make a short speech, play a record and give a rendition of 'O Holy Night' on his violin."

This, of course, is possible.

I distinctly recall on one or two occasions receiving voice at the far edge of the dial on my little Heathkit QRP rig. And people have been known to receive radio broadcasts through the fillings in their teeth, after all.

At this point we have to ask ourselves whether this might be one of those urban legends that grows with each telling, like the alligators in the New York sewer.

Too many things just don't zero-beat. Let's examine a few.

Marconi's successes with Hertzian waves were incremental, progressing bit by bit with each improvement in his equipment. His work was monitored by many supporters and under scrutiny by more than just a few enemies. But when he succeeded in jumping the three dots across the Atlantic—December 12, 1901, wasn't it?—the world literally and figuratively gasped. It was big news to an incredulous public. The impossible had been done.

It was comparable, in its effect on the public, to the news of the first Moon landing in the '60s.

According to one account, "The press of the world went mad. Pages were filled with jubilation, disbelief, triumph. 'Wireless' was on everyone's tongue ..."

That the undersea cable companies despaired at the news and immediately mounted their counteroffensive should tell us something. They had been monitoring the situation closely, for financial reasons. Why hadn't Fessenden's feats provoked the same reaction?

Unless we are to believe that Marconi's public relations skills were as advanced as his research.

Yet here is the goodly professor Fessenden doing far greater things with voice and music, just a few hundred miles away, in an area far more populated than the eastern cliffs of Newfoundland.

And no one knows about it.

No, that's not quite true, because there were those people on the yachts in the St. Lawrence, the sailors on the banana boats in the Caribbean, and the people up and down the East Coast. They would know about it. They were, after all, the recipients of the transmissions. But I guess they didn't care about it. It didn't make much of an impression. It was nothing. Just one of the professor's funny little gadgets.

For certain they couldn't have bothered to tell anyone else about it.

Give us a break, please.

Why would Marconi's three little dots cause such a kerfuffle and Fessenden's airwaves' violin sonata be ignored? Unless it didn't happen, perhaps?

Now, as history goes, all these things happened just the day before yesterday, relatively speaking. A hundred years ago more or less. Just like Marconi's equipment, Fessenden's equipment must still be around, in museums, in universities, in the attic—somewhere.

The proof of the pudding, as grandpa used to tell grandma, is not in the telling, but in the eating.

So, too, the proof of Fessenden having outdistanced Marconi must have been in the doing. Get out the equipment and demonstrate two things: (1) that its design and construction predated Marconi's accomplishments; and (2) that it works.

The equipment is no longer available? Every scientist leaves papers, notes, detailed plans. Get them. Build it. Do the same thing.

Zook and other writers hint that Fessenden's work was suppressed and Marconi's made to flourish because of sinister commercial forces. That notion, however, is not consistent with the proposition that commerce will tend to support the earlier, better product. Investors, after all, (dare I utter it?) hope to make money.

True, Marconi was very commerce-oriented, but it was that same commerce that ultimately supported and advanced his science. Which is as it should be. We are led to believe that Marconi's science was somehow tainted because it was commercially driven. Try telling that to Bill Gates.

This resurrection of Reggie Fessenden and his misty deeds has a curiously stunning parallel in the field of aviation.

Did you know that a full two years, four months, and three days before the Wright brothers flew at Kitty Hawk, another person had already beat them to it?

No, it was not some obscure Russian whose unsubstantiated claim is based on Cold War revisionism, but a real live American resident.

His name was Gustave Whitehead. He was a German immigrant living and working in the United States of America. He did it at dawn on August 14, 1901, near Bridgeport, Connecticut. It is well documented. It was in a heavier-than-air, power-driven airplane of his own making. He took off from a level runway. He made four flights that day.

As with Fessenden, Whitehead's accomplishment was also purportedly suppressed by commercial interests supporting the Wright brothers. It is alleged that the Smithsonian Museum has been party to that suppression.

Don't believe me?

Go to Web site [http://www.deepsky.com/firstflight/] and read for yourself about Gustave Whitehead and the Smithsonian Conspiracy.

Perhaps he and Fessenden, victims both, now commiserate with each other in the great beyond.

So, Mr. Marconi, you can take comfort. You are safe. Your record stands. It's not as if usurpers haven't come along before. They've always been there, perhaps always will be.

Meanwhile, I still have a two-meter quad that needs building.

James Fontana is currently working on a novel based on the life of Guglielmo Marconi.

The Evolution of Power Supplies

continued from page 14

wave, fast voltage transitions were created which were transferred to the secondary as spike voltages having a very high amplitude.

A buffer capacitor was required across the secondary winding to roll off the spike in order to smooth the output. To simplify the concept of operation, pulse dampening resistors and spark suppression capacitors used with vibrators were intentionally omitted from the schematic shown in **Fig. 4**. The spikes were always a noise source requiring correction, and they were particularly troublesome for hams operating in the 10-meter band.

Poor contact reliability with single contact configurations created the development of dual-contact vibrators, which resolved some of the contact burning and erosion problems that were inherent with single-contact ones. The vibrator contacts were alternating switches which caused current to flow in alternate halves of the primary winding in a manner similar to a push-pull action. Having a large switch contact surface, the vibrator contact provided full battery voltage to each half of the transformer winding.

Many radio old-timers will remember rectifiers such as the 0Z4, 6X5, and 6X4 that were used in the early radios. The 0Z4 was a gas-filled dual-diode tube without a filament that gave off a bluish-purple glow when it was operating. The sharp eye of the technician was able to detect potentially defective 0Z4s, when the color would begin to change to a yellow-red, and/or when the glow began to flicker.

Between 0Z4 and vibrator contact problems, technicians were kept quite busy repairing vibrator supplies. In later years, many vibrator power supplies were improved by replacing the 0Z4 with solid state diodes, and eventually the vibrator was changed to a pair of transistors operating as saturated switches that plugged into the vibrator socket. The transistorized device was called a vibrator substitute.

Power supplies are an interesting subject, and the study of the changes to them provides a lot of insight into the significance of the various designs that have been around from the very earliest days of radio. On the surface, it would appear that the changes have been small or insignificant, but consider the changes that have been instituted as a result of technological developments, and to meet the many faceted needs of ham radio.

In Part 1, our discussion has involved primarily dynamotors and vibrators which were used in mobile power supplies. Part 2 will continue with the subject of power supplies and will involve switching power supplies that are a takeoff from the vibrator supply concept. Switching power supplies are used in many applications, including home computers and mobile radio systems. I hope that the theory and schematic diagrams included will provide you with some of the many clues that are needed to troubleshoot and repair switching power supplies. 73

George's XE-lent Adventure

Part 1: Days 1–9.

George Pataki WB2AQC
84-47 Kendrick Place
Jamaica NY 11432

Usually, when I visit the amateurs in a foreign country I go around to various cities to see as many hams as I can. During my recent trip, with one exception, I stayed only in a single place: Mexico City, which with its 20 million inhabitants is as big as many other entire countries. Mexico is very large, so going from one major city to another requires long travel. And even after taking such a trip you may find only one or two active amateurs, so it might not be worth it.

Preparing for the trip

Long before my trip, I wrote a letter to the *Federacion Mexicana de Radio Experimentadores* asking for their cooperation in finding active hams. I guessed that I wouldn't get any answer, and I was right. I wrote them anyway as a matter of courtesy, wishing that this might be reciprocated.

I also wrote a similar letter to Luis XE1L, whom I had once met by chance for about 30 seconds in Dayton. Luis was very cordial and helpful, and in exchanging a bunch of E-mails before the trip he gave me lots of valuable information. During my stay in Mexico City, he also helped me locate several known DXers.

I took with me a two-meter HT and tried to find amateurs by contacting them, but this was a failure because virtually all Mexican repeaters need a tone to open them—and my HT does not have such a capability.

Sunday

My friend Mike AB2DP and I took an early-morning flight from La Guardia airport in New York City, changed planes in Dallas/Ft.Worth, and arrived in Mexico City in the early afternoon. We changed some money at the airport (8.33 pesos for the dollar). I called up Luis XE1L (**Photo A**) and he advised us what to do. At the taxi service booth we gave the name of a hotel, prepaid the fare (86 pesos), and received a ticket which we then gave to one of the many drivers waiting outside the terminal. This is a safe way to travel, although there have been instances when foreigners have been robbed by taxi drivers and their accomplices.

The taxi took us to a hotel in an exclusive neighborhood. I again called up Luis XE1L, telling him that we were all right, and then I called up Theodoro XE1YQQ, a Romanian expatriate, who came to the hotel to meet us with his wife, Rosa XE1YQR.

A short time later, we got a call from Luis XE1L, who was in front of our hotel with his family. We all went down to meet them, and then later Theodoro took us to their house to show us their station. Theodoro and Rosa own a large hardware store. They were licensed in 1995 and love amateur radio, and both have over 100 countries confirmed. Their son Leon XE1YQS is busy with high school, girls, computer, and guitar (**Photo B**).

On the top of their 60-foot tower, they have a seven-element yagi for 10-15-20 meters, an R7 vertical by

Photo A. Luis XE1L uses a six-element yagi on 6 m and an 80-element yagi for 432 MHz for his ATV.

Photo B. Son Leon XE1YQS, mother Rosa XE1YQR, and father Theodoro XE1YQQ are the friendliest radio amateurs in Mexico City.

Cushcraft, and a longwire for 40 and 80 meters. Theodoro XE1YQQ and Rosa XE1YQR have very nice QSL cards with slogans like "The QSL is the final courtesy of the QSO" and "We are not strangers, just friends who haven't met." I can testify that indeed they are very good friends. Even Leon XE1YQS, who is not very active, has a QSL card.

Next to see was Luis XE1L. Luis is a highly regarded architect, and I saw several houses he designed and built, including his own. Licensed in 1973, he is one of the best-known DXers in Mexico. He has operated from various exotic locations such as Peter I Island 3YØPI; Revillagigedo XF4L; Easter Island XRØY; South Shetland 4K1/XE1L; Martinique FM5/XE1L; Saint Martin FS5/XE1L; Barbados 8P6/XE1L; Mayreau Island FL5/XE1L; 4U1UN; 4U1ITU; 4U1UN/4X4/XE1L, etc.

Luis has a 54-foot tower on his roof which is 20 feet above the ground; on that tower is a seven-element yagi for 10-15-20 meters. A second tower, also 54 feet high and installed on a lower roof, has his three-element yagi for 12-17-30 meters. A third tower, also a 54-footer, carries his six-element yagi for six meters. Other antennas include his 80-element yagi for 70 cm (used for fast scan ATV), and two meter and 70 cm antennas used for satellite communications. He also operates an open repeater on 144.63(-) MHz. Luis XE1L has a very nice QSL card, and his manager is Mary Ann WA3HUP. Luis' E-mail address is: [xe1l@mail.internet.com.mx].

While we were admiring, with increasing envy, his huge station with various pieces of equipment and gadgets, Nellie XE1CI, another of Mexico's real big guns, showed up with her little poodle, "CQ." The poodle understands only Spanish, so you have to call him "See Koo" (Photo C).

Mike AB2DP and I later returned to

Continued on page 36

Photo C. DXer and DXpeditioner Nellie XE1CI has a poodle named "CQ."

Photo D. Michel XE1MD is a DXer, builder, and experimenter.

George's XE-lent Adventure

continued from page 35

our hotel, which was expensive and yet did not have air conditioning.

Monday

With the help of Theodoro XE1YQQ and Rosa XE1YQR we moved to a cheaper hotel in one of the business districts of Mexico City, in its historic center. I found out that the prices of many things are negotiable in this country. We got a 20% discount at Hotel Capitol and paid about $25 for a double. The hotel was very nice and quiet, with the window opening to an inside Spanish-type courtyard. The room was hot; it was unusually torrid weather in the country, and even the locals were complaining. Theodoro lent us a small fan which made our life bearable. The hotel has a very good restaurant with reasonable prices.

With Theodoro XE1YQQ and Rosa XE1YQR, with whom we visited almost daily during my 18-day stay, we went to see Michel XE1MD (**Photo D**). Michel, a retired medical doctor, was born in France and came to Mexico in 1962. Licensed in 1979, Michel is very active on the bands and is a good QSLer. He wrote a very interesting book, *El Arte del DX*, which was also published in French with the title *L'Art du DX*.

Michel XE1MD has a 60-foot tower on the roof, which is 20 feet from the ground. On the tower, he has a five-element yagi for 10-15-20 meters, and an inverted vee for 40 and 80 meters. Michel is also using a magnetic loop type of antenna up to 100 watts, on frequencies continuous from 13.9 to 29.0 MHz. He is a builder, and has a separate little shack for his constructions. He gave me some leads to meet other local hams. Michel is a DXer and is on the Honor Rolls for both phone and mixed, and he does have QSL cards.

Even if the *Federacion Mexicana de Radio Experimentadores* did not answer my letter, we had to pay them a courtesy visit. Around 6:00 p.m., Theodoro XE1YQQ, Rosa XE1YQR and Michel XE1MD took us to their headquarters. There we found Don Ramon, a secretary but not a ham. We saw the QSL bureau, where Jose XE1XOK, Carlos XE1POO, and Virginia were sorting cards. We also saw well-equipped station XE1LM, and their tower with a five-element yagi. However, nobody could find any of their QSL cards.

The Federation, and before that the League, used to publish a bimonthly bulletin *Onda Corta*, but they stopped in 1995.

I bought their latest callbook, issued in 1993 and listing over 8,000 hams. The callbook is not updated, even to the date of publishing; I found several hams licensed in 1990–92, but other people are listed under their callsigns. If you cannot hear many XE calls on the air, it is because most of them are on two meters or inactive. I was told that while the number of hams in most countries is increasing, in Mexico is decreasing, mostly because no new licenses were issued during the last couple of years.

Late in the evening, at the hotel I was awakened by an unsolicited room service with some drinks. Next morning, I was again awakened by an unsolicited wakeup call. At least they knew that we were there.

Photo E. Sam XE1ZLW, a medical doctor, is an Honor-Roll DXer.

Tuesday

Mike AB2DP and I went shopping to *Artesanias Ciudadela*, a very large market serving mostly tourists, about seven or eight blocks from our hotel. After hours of walking around, comparing merchandise and prices, I bought nine colorful blankets in various sizes, made of cotton. The ones made of wool were three times more expensive. I was taking them as gifts and I knew the receivers would not know the difference, so I bought the cheaper ones. Curiously, I know that I bought nine pieces—I packed them myself—but when I arrived home there were only eight blankets. I don't even try to figure this out.

For the afternoon, Theodoro XE1YQQ set up a meeting with Sam XE1ZLW, a member of the local club, in a large parking lot of a shopping center in Satelite, a suburb of Mexico City (**Photo E**). Theodoro and Sam did not know each other, and each agreed to recognize the other by the color of the silvery cars both were driving. We went to the parking lot and you wouldn't have believed how many silvery cars there were. Both Sam and we waited about 20 minutes, not far from each other. From time to time Theodoro asked drivers of silvery cars if they were Sam, but nobody wanted to admit to that. Finally, Sam was found and we all went to his house. It seems that most Mexican hams have very nice houses, and Sam is no exception. This is because only members of the upper middle class seem to have the amateur radio hobby. The rest of the country goes for soccer, and that does not require expensive equipment—just strong arms and legs, and a really big mouth.

Sam XE1ZLW was born in Minnesota and brought to Mexico when he was one week old. In 1985, he started as a CBer because his house was damaged during the big earthquake. He moved to a new neighborhood without telephones, and he needed communications. In 1987, Sam got his amateur radio license. He is on the Honor Roll, missing only North Korea. In the same situation are several more of Mexico's big guns: Luis XE1L, Nellie XE1CI, Vic XE1VIC, Fernando XE1AE (and

others around the world). It seems that placing North Korea on the DXCC list, after Romeo's phony adventure and just a very limited token operation, is considered a very controversial decision here.

Sam's tower is 63 feet tall above his roof, which itself is 45 feet from the ground. His house is on high ground with an unobstructed view all around. His 11-element TH11DX Hy-Gain antenna for 10-12-15-17-20 meters and his two-element Hy-Gain antenna for 40 meters also help him breaking the pileups. Sam is using his tower and a wire extension for 80 meters, and with the antenna tuner he can even get up to 160 meters. He is a member of the International DX Association and he is a good QSLer. His E-mail address is: [xe1zlw@supernet.com.mx].

Sam XE1ZLW is the past president of the Satelite city radio club, which now has about 40 members, a callsign, and a nice QSL card for a nonexistent radio station: XE1RCS. Yes, while I met many hams with stations but without QSL cards, here was a club without station but with nice cards. The members meet the last Tuesday of the month, at 9:00 p.m., in a restaurant. After a long discussion, they decided that the meeting place was in a bad neighborhood and we should not go there. This was around 6:00 p.m., and I suspect that Theodoro did not want to wait another three hours until the time of the meeting, so we went home.

Wednesday

Mike AB2DP and I again went sightseeing and shopping in the *Mercado de Curiosidades y Artesanias*, about two blocks from our hotel. I would have said "window shopping" because we did not buy anything, but the place has no windows. There are 167 stalls and the merchandise is all over the place. As you pass through the hallways, the dealers greet you and invite you to see their stuff. Bargaining is the rule of the house. It is relatively easy to push down the original prices 20–25%, but later you will still find the same items for less than you paid. So first just look around; then take notes on the what, where, and how much of the various things you are interested in buying; and then, on the last day or so, do the actual shopping.

The exchange rate is better in the city at various *cambios* than at the airport; we got 8.4 pesos for a dollar. There are no black marketeers or street exchangers as in many other countries.

Thursday

I wrote a bunch of postcards and bought some magnets for my wife. They cost two pesos and come in endless varieties. Of course, I told my wife that they cost much more than they did. As I am crazy for QSL cards, she is even crazier for magnets, and has hundreds of them on two refrigerators and a microwave oven.

I sent the postcards airmail; about 25 days later, they still had not arrived in New York. Probably they went on the long path.

We went to see Carlos XE1GC, an anesthetist still working at age 72. Carlos was licensed in 1976, works mostly SSB, and is a DXer with over 100 countries for his DXCC. He has a three-element yagi for 10-15-20 meters, and a wire dipole for 40 and 80 meters. Carlos XE1GC does have QSL cards.

Beginning in 1970, Carlos maintained radio communications for several sea expeditions on balsa rafts and ships, such as the 1984 voyage of the *Atlantis*. In 1993, he sailed for a month on *Marigalante* as a radio operator.

Friday

Mike AB2DP and I, not having any amateur scheduled to visit, decided to go on a trip. We booked a tour called "Pyramids of Tula and Tepotzotlan." We each paid $35 to a tour operator, and a guide with a microbus picked us up at the hotel at 9:00 a.m. We then went to get another tourist, a guy from Malaysia, and we started the journey. The guide made an offer: For an extra five dollars, he would take us to two extra places not included in the tour. We accepted and paid him.

We visited a few places, the names of which I don't recall and I couldn't even pronounce anyway. We saw an old church in Santa Clara on our way to the Jesuit monastery of Tepotzotlan,

Photo F. Cuernavaca's Fernando XE1AE has worked every country on the DXCC list except North Korea.

built in the 17th century in a Mexican baroque style, with hand-carved altars covered with gold. You are not allowed to use a flash when photographing there, as allegedly it rubs off the gold, so Mike AB2DP ended up using a whole roll of film for indoor shots in the dark interior using outdoor settings. Not even the Holy Ghost will be able to make those photos come out right.

We continued to Tenayuka, to an Indian ceremonial center predating the Aztecs, and then to the archeological site of Tula, about 65 miles from Mexico City. There we saw the pyramids and some large statues of warriors called *"atlantes."* It was a very hot day. Somewhere we stopped for a lunch that was not included in the price of the tour.

Photo G. Mexico City's Dieter XE1AMS is also an Honor-Roll DXer.

Around 6:00 p.m. we returned to our hotel. On the way, I stopped at an ice-cream-on-a-stick vendor on a street corner. He was offering his beautifully colored stuff as "orange," "mango," "pineapple," and other tropical fruit. I bought a "mango." It was green, but it tasted like nothing. I threw it in the garbage and bought an "orange." It was gorgeous pink, but again it had no flavor at all. Gently I deposited it near the "mango" and bought a "pineapple." This one was a magnificent yellow, but, yes, you guessed it, it had no taste at all. It followed the "mango" and the "orange." And people kept buying them. It would have been nice if they would have called the stuff "green," "orange," "pink," or whatever color they had, instead of calling them what they don't have.

Saturday

Theodoro XE1YQQ and Rosa XE1YQR, who were the best guides I have ever had on any of my trips, took us to Efraim XE1JGM. Efraim is an electromechanical engineer and past president of the *Radio Club Azteca*. Just like Sam XE1ZLW, Efraim got into amateur radio by necessity, in 1986, to keep in touch with friends and family after the 1985 earthquake. He has a very nice station, a tower with good antennas, but he declined my invitation to climb his tower for a photo, even if it was indeed very well anchored.

Efraim's wife Tessy teaches Hebrew in a Jewish school; she was licensed in 1986 as XE1XTN. Despite their very good station with lots of equipment, nowadays both operate mostly on two meters, usually making local contacts. Efraim has QSL cards, while Tessy does not.

Efraim told me that in Mexico you can take the test from the age of 12. There are four categories of licenses but everybody I asked remembered them differently. I believe they are:

Primera (Extra): 1,250 W on HF, 500 W on UHF and VHF.

Segunda (General/Advanced): 500 W on HF, 200 W on UHF and VHF.

Novato (Novice): codeless, not renewable, 150 W on 40 and two meters.

Restringido (Novice): codeless, not renewable, 50 W on 40 and two meters.

In the Mexican callbook I also see another category, *Principiante*, which is probably *Novato*.

In the evening I got a phone call from Fernando XE1AE, who invited us to Cuernavaca, a city about an hour and a half away from Mexico City by car. We also heard from Dieter XE1AMS, right in the capital, and we agreed to visit them both the next day.

Sunday

Mike AB2DP suddenly decided that he had had enough of the heat. He changed his airline tickets and returned to New York. As they say: "If you can't take the heat, get out of the kitchen." Or, get out of the country.

Theodoro XE1YQQ, Rosa XE1YQR, Michel XE1MD, and I left early in the morning for Cuernavaca at the invitation of Fernando XE1AE (**Photo F**). The previous night, I had told Fernando that I prefer to go where there are many hams. He said there were quite a few in his town. Fernando also asked me what time we would be arriving, because he wanted to prepare lunch for us. When we got there, I took his picture on the roof with his 76-foot tower with a TH11DX, 11-element yagi; an inverted vee for 40 and 80 meters; and an 11- + 11-element yagi for two meters. Fernando has 368 countries confirmed and over 500 awards. He also has QSL cards.

Fernando XE1AE was licensed in 1956; he sells and installs radio communications equipment. He is a big guy; I can imagine him selling anything he wants, but I don't see him climbing roofs and towers to install antennas. He is in Cuernavaca only from Friday to Sunday; the rest of the week he is at his home in Mexico City, where he has another radio station.

When I finished my work, we sat down chatting about DX and waiting for the promised lunch, which never materialized. When we asked him about the "many hams in Cuernavaca," Fernando changed his story and said that he did not really know them because he

was only there three days a week. It's happened before, and it happened again. An amateur who wanted to be featured in a magazine lured me with promises and delivered little. OK, no lunch and no other hams.

He kept slapping me on my back and saying: "I like you George, you are a character. I like you, George."

I kept slapping him back and saying: "I like you, too, Fernando, you are a bigger character than anybody I know. I like you, too, Fernando. But I am known to have very poor taste!"

Fernando is in the middle of a long line of Fernandos: his father and grandfather were Fernandos; his son is Fernando XE1FVV, but inactive; even his little grandson is Fernando.

We left Fernando's hungry, and went to see Geoff XE1GE, born in Mexico in 1907 of English parents. Starting in 1928, Geoff was a second operator at X3A; in 1933, he received his own call: X1BG. His license was revoked in 1934 because even though he was born in Mexico, he had no Mexican citizenship. In 1936, Geoff got back his license and used the XE1GL call until 1941, when everybody's license was suspended because of the war. After the war, Geoff came back as XE1GE. He has really kept on being reborn from the ashes.

Geoff XE1GE has a 30-foot tower on the roof, which itself is 15 feet from the ground. He is using a three-element yagi for 10-15-20 meters; a six-element yagi for six meters; a sloper for 17 meters; and three wire dipoles for 20, 40, and 80 meters. Geoff is a builder and experimenter. He works CW and SSB, and FM on two meters. Geoff XE1GE has worked 150 countries, and on six meters alone, over 60. He does have QSL cards and is the only living founder of the *Liga Mexicana de Radio Experimentadores*, established in 1932, which a couple of years ago became the *Federacion Mexicana de Radio Experimentadores*.

On our way back to the capital, we stopped to see Dieter XE1AMS (**Photo G**). Born in Mexico of German parents, Dieter is a business administrator for a digital creations company. He was licensed in 1985. His wife, Claudia XE1MGC, is the director of personnel at La Salle University; she works only on two meters. Dieter has a 60-foot tower, with a 13- + 13-element yagi for two meters and a four-element yagi for 10-15-20-40 meters. He is on the Honor Roll with 330 countries confirmed. His E-mail address is: [xe1ams@mail.internet.com.mx], and he has a nice QSL card.

Monday

I did not have anybody to visit, so again I became a tourist, walking around the city and window shopping. Right near my hotel was a huge computer and electronics complex with about 400 little stores, some of them as small as my walk-in closet. It has five entrances from three different streets. Its shops are open seven days a week, selling and repairing computers, monitors, printers, VCRs, and all such related equipment. As is the local custom, as you walk through the endless halls, the merchants greet you and ask what you are looking for. They have the very latest technology for sale.

Many stores have private security guards, some armed and wearing bulletproof vests, others unarmed. Probably there are more guards than thieves and robbers, but robbing and stealing is still a lucrative business.

They say one man was approached on a dark street by a stranger.

"Good evening, *Señor*. May I ask you for a donation? I have not eaten for days, and I don't have a job or a place to stay. I have nothing except for this knife and this gun."

The man gave generously.

On many street corners in rich residential sections of the city there are guardhouses with security guards checking the visitors. Some apartment buildings and even private houses have their own guards.

After checking out lots of stores, I found the best buys usually out of the tourist paths, where mostly the locals shop. In the big artisans' markets, the first asking price for a colorful T-shirt starts at 50 pesos. It can be bargained down to 40 pesos. The same merchandise is sold on the street for 20 pesos. When you bring this to the attention of the dealers asking 50 pesos, their standard answer is: "a different material." But I checked it out, and the material was the same—only the price was different.

I bought more than 20 T-shirts, a couple of ponchos, an "Aztec calendar" made of wood, and more magnets for my wife. Now we will have to buy a third refrigerator, because there is no more room on the two we have.

Next time: The sojourn continues, or *chili* today, hot *tamale*.

Special Events

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the February issue, we should receive it by Nov. 30. Provide a clear, concise summary of the essential details about your Special Event.

NOV 1

CANTON, OH The Massillon ARC will sponsor "Hamfest 98." Sun., Nov. 1st. at the Stark County Fairgrounds, 305 Wertz Ave. NW, Canton OH. Vendor setup at 6 a.m. Doors open to the public at 8 a.m. General admission $5, $4 in advance. Tables are $10 each. Info and reservations to *MARC, P.O. Box 73, Massillon OH 44648.* Include an SASE. An auction begins at 10 a.m. Talk-in on 147.18(+) rptr. E-mail to *[marc.hamclub@juno.com]*, or call *Terry Russ (330) 837-3091 before 10 p.m.*

DES MOINES, IA The Tikva Tracers ARC "Hamfest Iowa '98" will be held at the 4H Building, Iowa State Fairgrounds, in Des Moines. Setup Sat. 6 p.m.–9 p.m., and 6 a.m. Sun. Doors open at 8 a.m. Seminars and "Ask the Experts" will be among the featured goodies. Talk-in on 146.22/.82. Admission $5, first table $10, each additional $8, electric $8. VE exams at 9:30 a.m. Contact *Randal Lees NØLMS, 1575 Northwest 78th St., Clive IA 50325-1255. Tel. (515) 279-4241; E-mail [rclees@raccoon.com].*

NOV 7

ENID, OK The Enid Hamfest Group will hold the Enid Hamfest at Oxford & 4th Streets, at the Garfield County Fairgrounds (Hoover Bldg.), 8 a.m.–5 p.m. Admission $2, tables $1 each. Special features: Free doughnuts and coffee in the morning, free hot dogs and soda at noon. VE exams at 1 p.m. Contact *Tom Worth N5LWT, (580) 233-8473. E-mail [N5LWT.@HOTMAIL.COM]*; or *Fred Selfridge N5QJX, (580) 242-3551; E-mail [FREDNNEL@IONET.NET].* Talk-in on 147.15(+) or 444.400(+)

SORRENTO, FL A Hamfest, Computer Show and Electronic Expo will be hosted by the Lake ARA. Nov. 7th, at the East Chamber of the Commerce Building in Sorrento FL. Admission $5; vendor cost is $10 (includes one admission). Setup Fri., Nov. 6th, at 3:30 p.m.–6 p.m.; Sat., Nov. 7th, at 6 a.m.–8 a.m. VE exams (walk-ins only) at 10 a.m. For info and table reservations, contact *Chuck Crittendon KA4EXM, P.O. Box 615, Altoona FL 32705. Tel. (352) 669-2075.*

WAUKESHA, WI The Milwaukee Repeater Club will sponsor the 14th annual "6.91 Friendly Fest" on Sat., Nov. 7th, 8 a.m.–1 p.m. at Waukesha County Expo Center Arena Forum, N1 W24848 Northview Rd., Waukesha WI (I-94 to County J, south to FT, west to Expo). Sellers admitted at 5:30 a.m. Tickets $5. 4-foot. tables $5 each. Please call *Mike KB9PHA at (414) 258-4435.* Send an SASE with payment to *The Milwaukee Repeater Club, P.O. Box 2123, Milwaukee WI 53201.* There will be VE exams on-site. Talk-in on 146.91(-) (The Friendly Repeater), and on 146.52. Visit the Club's Web site at *[http://www.execpc.com/~mrc/friendlyfest.htm].*

NOV 8

KAUKAUNA, WI The Fox Cities ARC will present its annual Hamfest at the Starlite Club, corners of Hwy. 55 and Cnty. Rd. JJ. You must buy an admission ticket if you pre-register. Advance admission tickets $4 ea., 8 ft. long tables $8 ea. Send check or money order payable to *FCARC, 1912 Russett Ct., Appleton WI 54914, Attn: Chad Pennings N9PRC, Hamfest Chairman, tel. (920) 993-0485.* Registration for VE exams is 8 a.m.–9 a.m., no walk-ins after 9 a.m. Bring original license plus two copies, and a photo ID. For more exam info contact *Larry Siebers KD9IA, (920) 757-1167.* Talk-in on 146.52 simplex.

NOV 14

MONTGOMERY, AL The Montgomery ARC will host the 1998 Alabama ARRL Convention at the 21st annual Montgomery Hamfest and Computer show in Garrett Coliseum, at the South Alabama State Fairgrounds, located on Federal Drive in the northeastern section of historic Montgomery. Admission $5, free parking, all indoors including the flea market. Flea market setup 3 p.m.–8 p.m. Nov. 13th, and 6 a.m.–8 a.m. Nov. 14th. Doors are open to the public 9 a.m.–3 p.m. CST. VE exams will be conducted on site beginning at 8 a.m. Bring original and a copy of your current license, picture ID, and $4. Talk-in on 146.24/.84, call W4AP. Rag-chew on 146.32/.92 (with phone patch, "up/#down), 147.78/.18, and 449.50/444.50. Flea market reservations are required to ensure tables. For more info, write to *Hamfest Committee, c/o 2141 Edinburgh Drive, Montgomery AL 36116-1313,* or phone *Phil at (334) 272-7980 after 5 p.m. CST. FAX (334) 365-0558; E-mail [wb4ozn@worldnet.att.net].* Visit the Web site for late breaking news and events at *[http://jschool.troyst.edu/~w4ap/].*

NOV 14–15

FT. WAYNE, IN The 26th Annual Fort Wayne Hamfest & Computer Expo, sponsored by the Allen County Amateur Radio Technical Society (ACARTS), will be held at the Allen County War Memorial Coliseum at the corner of Indiana 930 (Coliseum Blvd.) and Parnell Ave. Open to the public 9 a.m.–4 p.m. EST on Sat., Nov. 14th, and 9 a.m.–3 p.m. EST Sun., Nov. 15th. Vendor setup is Fri. eve. and Sat. morning. Admission $5, with no advance ticket sales. Parking is $2. There are over 1100 commercial and flea market tables, all under one roof, containing both new and used radio, computer, and general electronics items. Vendors include several international ham equipment manufacturers. There will be many forums and meetings, VE exams on Sat., and presentations by special guest Gordon West WB6NOA. Shuttle bus service provided to and from commuter airport (Smith Field) and shopping centers. Talk-in on 146.88(-). For more info, leave a message on the answering machine at (219) 483-8163 (tables) or (219) 484-1314 (general info) and you will be contacted. You can also send an SASE to *ACARTS/Fort Wayne Hamfest, P.O. Box 10342, Fort Wayne IN 46851,* or visit the World Wide Web site at *[http:www.pipeline.com/~dagagnon/].*

NOV 15

BENSON, NC The Johnston ARS "JARSFEST 98" will be held at the American Legion Complex, near the I-95 and I-40 intersection. The indoor flea market will be open 8 a.m.–3 p.m. Tailgating 6 a.m.–3 p.m. There will also be VE exams. Contact *Bill Lambert AK4H, 7 p.m.–10 p.m. at (919) 894-3352,* or E-mail *[blambert@interpath.com].* Talk-in on 147.270(+600), 100.0 Hz pl.

NOV 16

ST. PETERSBURG, FL The Pelican Chapter #128 of QCWA will host its 8th Annual Catered Fried Chicken Picnic Nov. 16th, in shelter #13 at Lake Seminole Park, St. Petersburg FL. The time will be from 10:30 a.m. until whenever. Admission is $7.50 per person. The menu is fried chicken with all the trimmings, including dessert and drink. There will be prizes and goodies before the picnic. All QCWA members and guests are invited to attend. Tickets and reservations can be obtained from *Don Bice W4PCO at (813) 347-2707, or the Callbook address.* Talk-in will be on 145.29 (-600), the QCWA rptr.

NOV 20–21

OCEAN SPRINGS, MS On Nov. 20th and 21st, The West Jackson County ARC is holding its annual Hamfest/Swapfest at the Latimer Community Center North of Ocean Springs MS. The hamfest will be open to the general public 5 p.m.–9 p.m. on the 20th, and 8 a.m.–2 p.m. on the 21st. Admission is $2 per adult or $4 for an entire family. The Community Center is located approximately four miles north of

1-10, use exit 50, Ocean Spring MS. Free parking. Self-contained RVs may park overnight. Eight-foot sales/swap tables are $5 each. Advance deposits are required for sales table reservations. Talk-in on 145.110 MHz (-600). The station callsign is N5OS. Contact *Phil Hunsberger W9NZ, 1207 Lancelot Ln., Ocean Springs MS 39564, Tel. (228) 872-1499;* or *Harry McLemore KD4AK, (228) 872-0732.* Correspondence may also be sent to *West Jackson County ARC, Inc., P.O. Box 1822, Ocean Springs MS 39564.*

NOV 28

EVANSVILLE, IN The Evansville ARS and the Ham Station are getting together to present the 6th Annual EARS Evansville Winter Hamfest, which will be held Sat., Nov. 28th, 8 a.m.–2 p.m. Central Time, at Vanderburgh County Fairgrounds Exposition Center. Talk-in on EARS Wide Area Repeater Network 145.150(-)/146.925(-) and 443.925(+) Vincennes. [Alternate: EARS repeater 145.110(-).] Use 107.2 CTCSS on all frequencies listed. Free parking. Everything indoors. For table reservations or info, contact *Neil WB9VPG at (812) 479-5741;* or write *EARS, 1506 S. Parker Dr., Evansville IN 47714. E-mail [EARSHAM@aol.com].* The hamfest Web site is at *[http://members.aol.com/earsham/].* Setup begins at 6 a.m. Central Time on Sat.

SPECIAL EVENT STATIONS

OCT 11–NOV 7

MINNEAPOLIS, MN The 1998 Plenipot Meeting, being held Oct. 12th–Nov. 7th, will be accompanied Oct. 11th–Nov. 7th by special event station W98ITU, operating from Minneapolis MN. QSL cards are available from *W98ITU, P.O. Box 131415, St. Paul MN 55113 USA.* Remember to send an SASE. DX cards will be handled directly or through the W9 bureau. Operation will be on all HF bands, CW, phone and RTTY. Novice band operations are also being planned.

NOV 7

WINCHESTER, VA The Shenandoah Valley ARC will celebrate their 50th Anniversary by operating Special Event Station W4RKC on Nov. 7th, 1400Z–2000Z. Club members will operate the station on 14.335 MHz, 28.335 MHz, and 146.820 MHz. Stations contacting W4RKC may request a special 50th Anniversary QSL card by writing to *SVARC, P.O. Box 139, Winchester, VA 22604 USA.*

NOV 14

PAXTON, FL To celebrate Heritage Day, ARS K4QBH will be operating in the General portions of the 40, 20, and 15 meter bands from one mile away from the highest point in the state at 342 feet. For QSL, send an SASE to *Bill McRae K4QBH, PO Box 503, Paxton FL 32538.*

NOV 14–NOV 15

ALEXANDRIA, MN The Runestone ARC of Alexandria MN will operate WØW 1600 UTC Nov. 14th–1600 UTC Nov. 15th, to celebrate the 100th Anniversary of the finding of the Runestone (Birthplace of America). Operation will be on 7.250, 14.250, 21.350 and 28.450 MHz. Stations contacted may request a certificate. To QSL, send name and address to *WAØVVM Runestone Radio Club, 2301 S Le Homme Dieu Drive, Alexandria MN 56308.*

DEC 11–12

BETHLEHEM, IN The Clark County ARC will operate W9WWI, 1500Z Dec. 11th–2200Z Dec. 12th, in celebration of the Christmas season. Operation will be on General 75, 40 and 20 meters. To get a certificate, QSL with an SASE to *CCARC, 1805 E. 8th St., Jeffersonville IN 47130 USA.*

JAN 26–27

ST. LOUIS, MO All Amateur Radio Clubs of St. Louis MO will sponsor Special Event Station WØK during the papal visit of Pope John Paul II, Jan. 26–27, 1999. Operations from the Monsanto Amateur Radio Assn. shack will be on 10–80 meters, 24 hours per day. QSL with #10 SASE via *Rev. Mike Dieckmann KAØIAR, 703 Third St., Hillsboro MO 63050 USA.*

Above & Beyond

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

VHF to microwave preamplifiers

What started all this ruckus was the continuing construction of my 1296 MHz transverter, making improvements on the basic design that was built a few years ago. I am working on a power amplifier stage and getting that circuit up and running. I have to admit that every new project that is started opens up a full avenue of other electronic side paths that have to be addressed in the refining process of completing a rig for high-performance operation. I guess I will always be engaged in making further improvements to circuitry.

The construction of this rig was part of a very ambitious construction project, to put together a rig a month for each of the amateur bands from 1296 MHz to 10 GHz, for our microwave group meetings. I hoped to help spark interest in our other microwave bands.

I have to admit that I will do just about anything to promote interest both in these amateur bands and in construction in general, as both topics offer something to add to our electrical knowledge and to other frequencies' propagation studies. Because of my pure enjoyment of construction, I will try anything useful to our amateur interests in the microwave realm. This extended home-brew construction kind of adds a thrill to the hobby when I'm trying to find inexpensive parts to construct something useful and enjoyable.

As I stated earlier, this project started off with trying to construct a reasonably good GaAsFET preamp for my 1296 MHz transverter. The unit utilized a 1 GHz IF amplifier after the mixer that gave the system lots of gain and a noise figure of something in the 3–4 dB range. Not too bad, but still in need of improvement.

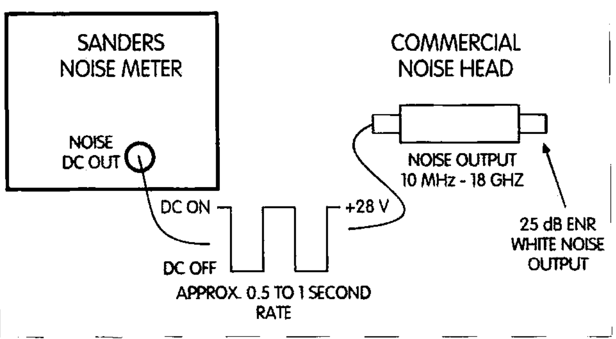


***Fig. 1.** Basic noise test instrument from Sanders, covering a frequency spectrum of 10 MHz to 18 GHz. Heart of unit is noise head driven by 28-volt power supply.*

The instrument used to make these noise figure measurements was a commercial Sanders noise figure meter located in surplus at one of our local swap meets. It has worked very well for me over the years. It's not an HP, but it was what I could find and has served well in helping me to align preamps for best performance (**Photo A**).

The noise figure meter is nothing more than a basic power supply that turns on and off at a pulse rate to turn noise on and off for testing (**Fig. 1**). This circuit can be easily duplicated as nothing more than a toggle switch or push-button to apply power to the noise diode circuit. With a switch, it would be in a manual mode, *vs.* automatically switching on and off at a preset rate, as in the Sanders meter.

What you are looking for, be it manual or automatic, is the maximum change between noise and no noise on your system S-meter or speaker output in an SSB mode of operation. (This test will not work for FM.) What you want to see with noise input to your system is maximum output of noise converted to audio as one measurement. You then turn the noise off and see what the difference is between

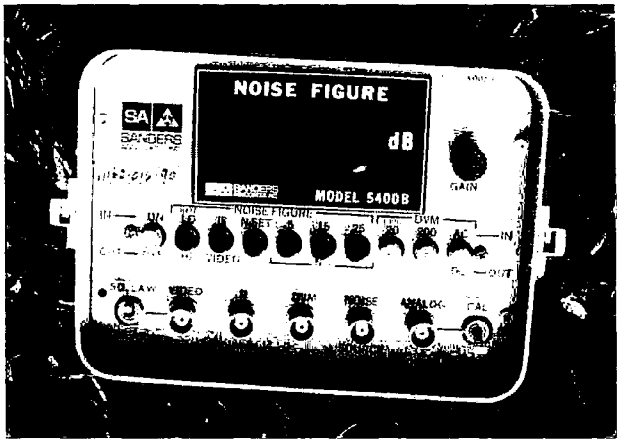


***Photo A.** Sanders noise figure meter, 10 MHz to 18 GHz operation frequency range. Capable of 25 dB excess noise output and can be used with external 10 or 20 dB attenuator to reduce noise for more sensitive systems. With a 20 dB attenuator attached to noise head, this will reduce the noise output to 5 dB ENR (excess noise ratio). Permits noise figure in the 1 to 10 dB range to be measured.*

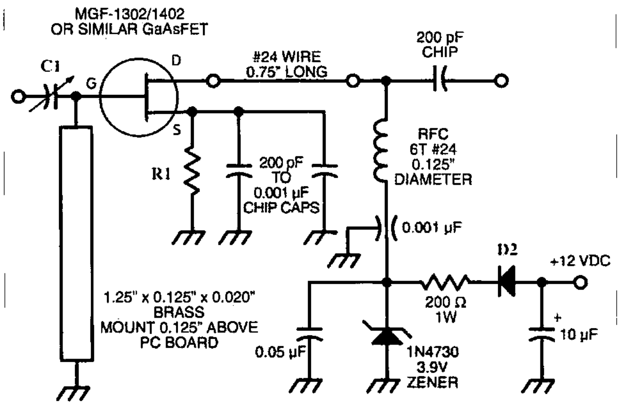


***Fig. 2.** GaAsFET preamplifier by WA5VJB from 1986* ARRL Handbook, *used as test circuit. This circuit selected because of simplistic design, low noise figure, ease of construction, and modest cost. C1 = 0.3- to 3-pF piston trimmer capacitor. R1 = 100 Ω, 1/8 or 1/4 W, carbon. D2 = 1N914 or 1N4148, or any with ratings of 25 PIV and 50 mA or greater.*

noise and no noise. The greater the difference, the better your system is working.

It would be best to know what the noise figure is, but I assure you that if you know you have adjusted your system for greatest difference as stated above, your system is operating as best it can. You may be in the same boat as my 1296 MHz system was before the preamp (5 dB ENR, excess noise ratio) was used for the test. That's the noise head with a 20 dB attenuator to reduce noise to 5 dB excess noise (ENR) as a signal source for test. I saw no change in the S-meter indicator on my SSB receiver when the 5 dB ENR was attached to the 1296 MHz converter, but was able to detect audibly the noise pulses in the radio's speaker.

In essence, the basic receiver converter was somewhat of low sensitivity, with switch losses degrading the system preamp and circuitry. To improve the noise figure, a preamp was constructed to improve receiver sensitivity. The parts and available construction articles were scanned. I found a preamp constructed using a single MGF1302/MGF1402 FET. The circuit was from Kent Britain WA5VJB. He had designed it many years ago, as it was published in the 1986 *ARRL Handbook*. I duplicated the circuit and was quite taken by its simplicity and ease of construction. Don't let it fool you—it is quite a performer for such a simple circuit. See **Fig. 2**.

The input circuit is a strip of thick copper or brass positioned by bending the end of the strip to one-eighth of an inch off the copper circuit board used as a blank substrate to solder parts to. A variable capacitor to adjust for minimum noise figure is placed in series between the stripline and coax connector center conductor to tune to resonance. The gate of the FET ties to the capacitor and stripline and is suspended in air about one-eighth of an inch above the copper PC board substrate by two chip capacitors (200 pF approximate, value not critical). These capacitors are positioned at a slight slant to make the one-eighth-of-an-inch spacing. The FET's source leads are soldered to the two chip capacitors.

The rest of the amplifier circuitry is quite straightforward. Just follow the schematic—the positions of other components are not critical. I mounted the bias resistor on the top source lead to ground. This self-biases the FET. The power supply is a simple voltage dropping resistor and a 3.9 V zener diode feeding the drain via a bypass feedthrough capacitor.

The perimeter of the PC board can be fitted with a small half-inch or so wide strip of PC board to form a cabinet to protect the circuitry. Solder the PC board strip to the outer edge of the main PC board. When the edge is finished, turn it over, and, with the coax connectors pointed up, square off any irregularities in the bottom of the box, making a tight fit when it's placed on a grounded surface. If you desire, the entire box can be screwed with one bolt to your main chassis with the other 1296 MHz converter parts. So much for the test preamplifier.

Diode noise generator

If you have a noise generator, you are ahead of the game; if not, read on—and we will construct a very simple one that will give good results. This will not be highly calibrated but will be sufficient to adjust the preamp used for demonstration purposes. The noise generator is just a diode or transistor base emitter junction of a microwave-type transistor, biased for conduction. The transistor is used as a single diode, making no connection to the collector. In essence it is being sacrificed to utilize its excellent high-frequency microwave specifications.

Most any device will function. Some do better than others. It's a trial that is not difficult. All that is required is a total frequency (F_t) rating of several GHz (the higher, the better). We do not need a power device in this application. The smaller the circuitry design, with minimum lead length, the better the noise source will perform at very high frequencies. Smaller is better.

As such, the generator's construction can take two forms, depending on circuit arrangements. The simplest device is shown in **Fig. 3**. This circuit arrangement applies the driving DC voltage (+24 volts) feeding a current limiting resistor and the noise diode to ground. RF output (noise) is taken from the junction of the resistor and diode with a small-value chip capacitor (10 pF approximate) connected to the small connector center conductor. This circuit, according to Noise Com, a leading manufacturer of noise equipment, is referred to as the "Low Frequency Bias Circuit," good to approximately 4 GHz.

The alternate version is constructed similarly, but the diode junction is connected in a slightly modified circuit. First, the current limiting resistor and diode junction are bypassed to ground with a .001 capacitor and the diode anode is placed in series with a 50 ohm resistor to ground. The output is taken from the junction of the anode and 50 ohm resistor. This circuit arrangement provides better noise output above 4 GHz according to Noise Com literature.

With either noise circuit, the noise diode (or transistor junction) acts like a zener diode current-limited by the resistor and supply voltage. Most noise units run on 24 VDC, making the limiting resistor in the resistance range of 1 kΩ to 10 kΩ. If you are constructing with an unknown device, use a small potentiometer in series with a 1 kΩ limiting resistor to find the best resistance value. Then replace the variable resistor with a fixed resistor.

Connect the noise source to your preamplifier RF input and set the variable resistor to maximum resistance. Apply 24 volts and slowly lower the pot in resistance value for maximum noise. Stop when there is no further noticeable noise output as the variable resistor is lowered in value. Don't rush and go to minimum resistance as with minimum pot—you would burn up the diode if we had not placed a limiting resistor of 1 k in series with the pot for testing. Depending on the diode or transistor you selected for test, current through the device will be in the range of 1 to possibly 10 mA.

If you are fortunate enough to have a noise diode that performs better than expected and produces so much noise that it makes it difficult to adjust to the best noise output, try placing an

Continued on page 44

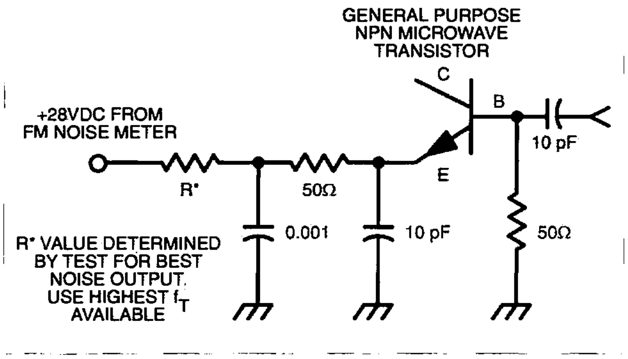


Fig. 3. Simple home-constructed noise head that produces good results and can be easily reproduced. Circuit is constructed on the back of an SMA or type-N coaxial connector for minimum lead length.

Hams with class

Carole Perry WB2MGP
Media Mentors Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Plug with passion

So much of what I'm involved with lately in the promotion of amateur radio in the schools has to do with giving presentations, either as a solo speaker or in conjunction with a club. Many of us who promote amateur radio in public forums need to learn as many good techniques as possible in order to deliver our message most effectively.

A lot of the good speaking habits I've picked up through the years have come about as a result of my membership in a group called "Toastmasters." In this organization, members participate by giving speeches in many different kinds of situations. One of the most helpful articles I've read through this club was written by Melanie Lim and is called "Plug with Passion."

Here are some of the points Melanie stresses when preparing to do a guest presentation at an event. Envision the event. Decide what your goal is for that meeting or event. Then use these tools to help clearly define your strategies.

She recommends that you dare to be different. Letters of invitation are informative, flyers are interesting, but E-mail is much more personal. Traditional and conventional ways of doing things aren't bad, but they can be boring. Sometimes you need to break tradition (not laws) to get attention. Send an E-mail titled, "Get an FCC License" and the message will end up unread, in the trash bin. Try another more imaginative line like, "Learn to Ride the Airwaves for Free" and people will read further.

Embrace energy and excitement. Enthusiasm is contagious. So is the flow of adrenaline. But if you don't have it, you can't pass it on. You can't effectively sell something you really don't believe in. There is no better sales pitch than old-fashioned excitement and energy.

Next, remember to market the memories. Most people don't like to be preached to. For example, they don't want to be told that if they don't attend a particular event, they're going to miss a golden opportunity for information and opportunity. Most folks, however, feel privileged to be invited to participate in history, and they don't mind being pursued with passion for such a momentous occasion. So don't sell the seminar, sell its significance. It's not that people don't want to be part of something "educational"—"unforgettable" just seems more irresistible.

Furnish the facts. Be sure to provide all the facts: the date, time, location, directions, dress code, registration fees, program, and other essential information for the event. Make it easy for people to attend the activity. Anticipate the questions and answer them before they are asked.

Seduce the senses. Don't just publicize your event—romanticize it! Appeal to the senses with your media and publicity efforts. Save the cold, literal facts for a thesis paper and promote your event with style, colorful phrases, and words that conjure up warmth, friendship, excitement, and fun.

Maintain the momentum. Never let up on your efforts to bring in people to the event. Once you become complacent, you may have lost the key to success of the event. People tend to forget, so keep plugging away right up to the last minute with reminders. Strategically placed ads and posters should be

---

Above & Beyond

continued from page 43

RF attenuator in between the noise head and RF converter. What is happening is that you have a good noise figure to start with and don't need a lot of noise output to see the best adjustment. Just as with a signal generator you reduce the level of the test signal, in this case you reduce the noise output and retest.

On my commercial noise meter manufactured by Sanders, the noise output is rated at 25 dB ENR. This amount of noise is useful in adjusting a numb receiver or one with a poor noise figure by today's standard. For testing on a crystal detector it is top notch, as the noise figure is in the range of 15 to 20 dB. To make a measurement on such a system, high noise is required.

The common practice with noise meters is that when you have a calibrated noise source you have some idea of what range of noise figure you expect to confirm or adjust to. In the case of my Sanders Noise Figure Meter with 25 dB ENR, either a 10 dB or 20 dB attenuator is used to reduce the noise to much lower limits. For example, applying a 25 dB ENR signal to a sensitive system in the 5 dB or less noise figure range is like keying a transmitter next to the receiver.

With a 10 dB attenuator inserted between the noise head and receiver, there were large fluctuations between noise and no noise signals on the receiver S-meter. By inserting a 20 dB attenuator there is still a 2 S-unit difference between noise output and no noise output, making the receiver in the 1 dB or so noise figure range. Not bad for a simple, home-constructed 1296 MHz transverter.

You might need high output if the preamp you constructed is not in proper alignment, or other system problems are giving you poor performance. If that is the case, some repairs are in order to bring the noise figure into better alignment. Just placing a preamp in front of a poor receiver will not always give the results you expect. If your system is working up to snuff then a good preamp will help, but if you have trouble down the line it will just provide marginal performance.

I have started testing many different converters and have found coax relay contacts open and missing center pins in the coax connectors, to mention two problems. Yes, the system worked, but the performance was markedly improved when the defective relay or coax was replaced. Then and only then did a good preamp show its worth. If your system consists of a large chain of relays and coax connectors, make a simple DC continuity test in the receive and transmit cycles of the relay coax cable chain with the converter disconnected.

What test?, you ask. Well, a simple one: Verify DC resistance short from input of the antenna to coax out toward the receiver. That's the center pin continuity of the coaxial circuit. Do the same for the transmit side of the relay chain. Also, verify that the center pins of the cables are not grounded, by making a check between ground and the coax (relay's) center pin of each input circuit. We just want to make sure we are getting minimum loss from the antenna connections and the system.

Well, that's it for this month. Next month I will report on some antennas and tower structure, covering crosscoupling between antennas that you should be aware of. 73, Chuck WB6IGP.

Number 45 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

Home-brewing at its best!

From Mike Hail KE4GBE: Here's a suggestion for recovering otherwise discarded NiCd battery packs. "Each month, thousands of rechargeable batteries are bought for cordless phones, often unnecessarily. Consumers will many times replace the rechargeable batteries in their cordless phones simply because it's the easiest thing to do when a problem with the phone arises, or because they've received poor advice from someone, even though there may have been nothing wrong with the batteries to begin with.

"Radio Shack® and other NiCd battery dealers now offer a recycling service to their battery customers. Since disposing of NiCd cells in landfills is not environmentally responsible, recycling depleted NiCd batteries makes good sense, but often the cells that end up in the recycling bin are still very much usable. It can pay you to make friends with the store manager at one of these retail battery outlets, so that he or she will permit you to take some of the packs home for testing and possible further use. If you promise to return any unusable cells for proper recycling, and return the currently operational cells once they've been used up, then there's really very little reason why the manager won't go along with the idea.

"Personally, I've found that roughly one-third of the battery packs that I've obtained by this method are still serviceable. Sometimes the entire pack is okay; other times, just one cell is bad. In either case, I've been able save quite a bit of money on new NiCd batteries just by following a few simple procedures.

"Most of the cordless phone packs consist of three (3) 280 milliampere cells wired in series. It's important to remember that a good NiCd cell provides about 1.2 volts. Thus, a potentially usable three-pack should read about 3.6 VDC, or perhaps a bit more when just freshly charged. When you've located several good 3.6 V packs, cut off the connector, leaving about 1/2-inch to 3/4-inch of the original pack wire still attached. Try topping off the charge on the pack using a safe, one-tenth-capacity charger (28 mA) for 12 to 14 hours.

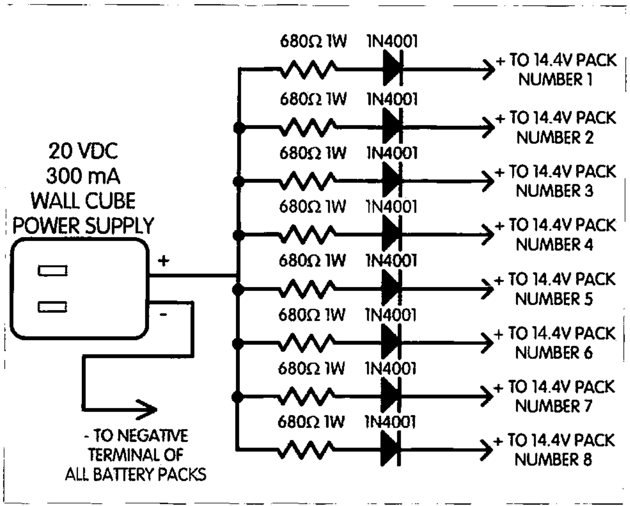


Fig. 1. The wall cube power supply and current limiting resistors should be chosen so that about 28 milliamperes is delivered to each of the 14.4 volt DC battery packs. The values shown represent just one such combination; the ones you select should be measured with a milliammeter to make sure that the proper one-tenth-capacity current is present.

"Now discharge the pack at a fixed current and see how long it lasts. If you can get close to the rated 280 mA capacity, you know that the pack is worth saving. Your exact end results can vary somewhat, so it's something of a judgment call. Mark the pack with your findings so that you'll know which pack delivered what amount of energy later on. A 280 mAh pack should deliver about 280 milliamperes for one hour, or 140 milliamperes for two hours, etc. Once you've salvaged several packs, then you're ready to build a larger, higher-voltage, higher-capacity, super-pack!

"If you need a pack to power a 12 volt DC QRP rig, for instance, four of the 3.6 V packs wired in series will give you 14.4 volts (about what an automobile battery delivers when the car is being driven and the alternator is replenishing the battery). To increase the current capacity (ampere-hour-capacity) of your super-pack, you can wire additional series-connected 14.4 volt 280 mAh packs and then put all of the packs thus wired in parallel. Each time you add another parallel group, you increase the overall ampere-hour capacity by about 280 milliamperes. I have one super-pack that contains 32 of the original 3.6 V packs — that is, four packs in series for 14.4 volts, then eight of these 14.4 volt packs in parallel. This 32-pack battery will deliver roughly

---

prominent and in places of high exposure.

Push for the personal touch. Form letters and bulk mailings are devised for practicality. Very often, however, "personal" works better than "practical." Queries should be answered with prompt, personalized replies. Pick up the phone or show up at gatherings to personally invite people to the event. It's the little things that make a big difference.

Deliver the delights. When the day of the event arrives, deliver the fun, the learning, the friendship, the passion, and the excitement you promised. There is no worse nightmare for a publicist than for the actual event to pale in comparison to the publicity campaign preceding it.

Build bridges. Sometimes, things come up in people's lives and they can't make your event even though they wanted to. Don't force the issue. You'll want them to attend your next event. If you know the people well who miss your event, and the follow-up notices are rave reviews, you may want to send them copies of the articles.

The bottom line is that everyone likes to be part of something fun, exciting, and informative. If your own enthusiasm can be projected into your advanced publicity, you'll attract an audience that will know they're part of a "special event." Good luck!

If you or your club has come up with some successful ways to advertise your events, please write to me so that I can share them with the readers.

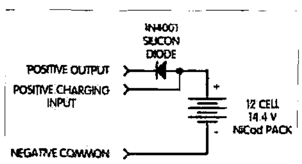


***Fig. 2.** Typical 12-cell, 14.4 volt battery pack showing one positive wire for charging the pack and another positive wire for discharging the pack into the operating load through a diode.*

two and one-quarter ampere hours of energy, and it was virtually free! With it, I've been able to run my CW QRP rig for about two hours (at 1.5 A average drain).

"It's best to charge the series-connected packs individually, but that only requires eight current-limiting resistors, and eight silicon diodes, fed by one charger capable of delivering about 20 volts at 250 mA. **Fig. 1** shows the basic schematic diagram for such a simple charger using a readily available 'wall wart' power cube. It's about as basic as a reasonably constant-current charger gets and, of course, you should feel free to improve upon the design to make the current delivery even more 'truly constant' if you wish.

"So there you have it—you can help out the ecology and save money at the same time ... to me, that's home brewing at its best!"

*Moderator's note: When connecting several NiCd battery packs in parallel, it's a good idea to also place a silicon diode (such as a 1N4001) in series with each pack's positive output lead (see **Fig. 2**). This added diode prevents the tendency of unequal packs to "charge" one another during use. More important, if one of the packs should catastrophically fail (e.g., short), it will prevent the good packs from feeding the short and draining themselves at a high rate of current. A small potential will be dropped across the diode (about 0.7 V), but it's worth it for the added reassurance. Remember that a separate "charging" wire is needed, however, to bypass around the diode when recharging the pack. The pack will now have three wires coming from it ... one positive wire for charging, one positive wire (with the diode in series) for parallel operation, and the remaining common (or negative) wire.*

As mentioned, each good NiCd cell should read 1.2 VDC when it has taken a proper charge, so it's relatively easy to determine if a pack has all good cells, or just if one of its cells is defective. By the way, a fully charged NiCd cell will actually read 1.4 VDC when it just comes off the charger, but will then fairly quickly drop to 1.2 V when under load. A good cell should also hold closely to that 1.2 V figure for the bulk of its usable charge-life (before it needs recharging). If a cell reads zero, then it's usually shorted internally. If it reads less than 1.2 V, or drops significantly below that figure under load, then it has an exceptionally high internal resistance and shouldn't be used.

Please remember to properly dispose of all of your dead NiCd cells at an approved recycling center.

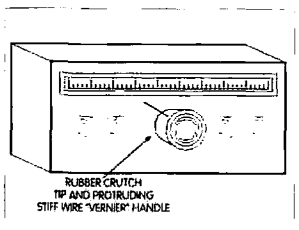


***Fig. 3.** A rubber crutch tip with a short, stiff piece of wire inserted and glued to one side can be used as an inexpensive vernier tuning adapter for many older radios. See text for more details.*

The five-minute bandspread!

From Bruce Cameron WA4UZM: "One of the biggest drawbacks to many older ham rigs is their tendency to tune too fast, even if they have some sort of mechanical vernier gearing built into them. Newer ham transceivers, with digital electronic tuning, offer a verrrrry slow tuning option, but here's something that you can try on your older rig without spending a fortune or investing hours of modification time.

"Just remove the present tuning knob from your radio and make a trip to your local medical supply store. There you'll likely find replacement rubber tips for use on crutches, canes, walkers, and other mobility aids. These replacement tips will often fit nicely over the current tuning knob on older equipment (just bring the knob along), giving you the basis for implementing the rest of this idea.

"Once you've located the right crutch or walker rubber replacement tip, insert a stiff piece of piano wire, sharpened to a point on a grinder or with a file, into the rubber tip as shown in **Fig. 3**. By the way, stiff piano wire can usually be obtained at any well-equipped hobby shop in town, or you can simply use a small section of a wire coat hanger. You may also want to put a tiny dab of glue or epoxy around the wire to keep it firmly in place. The wire needs to protude out of the crutch tip only two or three inches—short enough so that it clears the desk below when the knob is rotated. That's all there is to it! The new tuning knob cover with its protruding wire gives you the extra 'lever-arm' needed to make your old fast tuning action considerably more 'vernier' in feel and in action. Give it a try and you'll see what I mean."

Murphy's Corollary: In crisis situations that force us to choose among alternative courses of action, most will lead us on an entirely wrong course!

As we begin the fourth consecutive year of the "Ham To Ham" column in *73 Magazine*, we offer a very special thanks to this month's contributors, including:

Mike Hall KE4GBE
8131 Browning Circle
Ackworth GA 30101

William Bruce Cameron WA4UZM
430 Doric Court
Tarpon Springs FL 34689-2524

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the moderator at the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

HOMING IN

Radio Direction Finding

Joe Moell P.E. KØOV
P. O. Box 2508
Fullerton CA 92837
[Homingin@aol.com]
[http://members.aol.com/homingin/]

Practice, education and fun

Field Day is an important emergency preparedness exercise. That's what we always tell the local media, right? We don't admit, even to ourselves, that the main reasons we do it are to pig out and to play radio. Nevertheless, a lot of learning always takes place at Field Day. We figure out how to use unfamiliar rigs. We patch together a laptop computer, TNC and handie-talkie to make a working packet station. We dangle from poorly-supported towers to fix non-performing antennas. Some of us even renew our CW skills. In short, Field Day makes education fun.

Similarly, hidden transmitter hunting (sometimes called T-hunting or foxhunting) is an enjoyable and exciting way to learn and practice the skills of radio direction finding (RDF). Chances are good that these skills will come in handy for you at some point. There's always a need for hams who can quickly and efficiently track down the sources of stuck carriers, malicious QRMers, cable TV RF leakage, power line noise, and so forth. Some hams go a step further and volunteer to track down Emergency Locator Transmitters (ELTs, see **Photo A**) and other kinds of rescue beacons as members of the Civil Air Patrol, US Coast Guard Auxiliary or local search and rescue organizations.

You never know when signal-tracking skills will be needed. When they are, it's too late to practice. The more experienced you are, the speedier you'll be when it counts. The above-mentioned rescue agencies usually have training programs in RDF techniques, but you don't have to take a formal class to become proficient if there are enough "just for fun" ham radio T-hunts in your area. If there aren't, maybe it's time to get the ball rolling. One way for you to increase the number of T-hunters and RDF experts in your area is to teach it.

Ernie Howard W8EH recently wrote to tell about a four-week foxhunt class in Ohio. "It was at the same time and location as our normal Novice/Tech license classes," he wrote. "On the fourth week, we had an on-foot six-fox hunt at the local Miami University branch campus. Everyone got to practice using antennas they had just built. There were lots of woods and parking lots to hide things in, plus plenty of reflections to follow. We now have a dozen or more people interested in fox-hunting and everyone wants to know when the next one will be."

Practice pays

John Oppen KJ6HZ enjoys mobile T-hunting in the Los Angeles suburbs. Although he realizes the usefulness of sophisticated RDF equipment, he also likes to see how well he can do with nothing more than a handie-talkie or scanner, by paying close attention to the terrain and RF environment. In May of this year, he came to an international-style on-foot foxhunt that I put on in Placentia, California. All the other competitors used their special amplitude-based sniffers, Time-Difference-Of-Arrival add-ons, and so forth. John used only his handie-talkie and the "body shield" technique. He punched in at all five transmitters in the 65-acre hunt area and got to the finish line 11 minutes ahead of the second place finisher.

John's RDF experience and

Continued on page 50

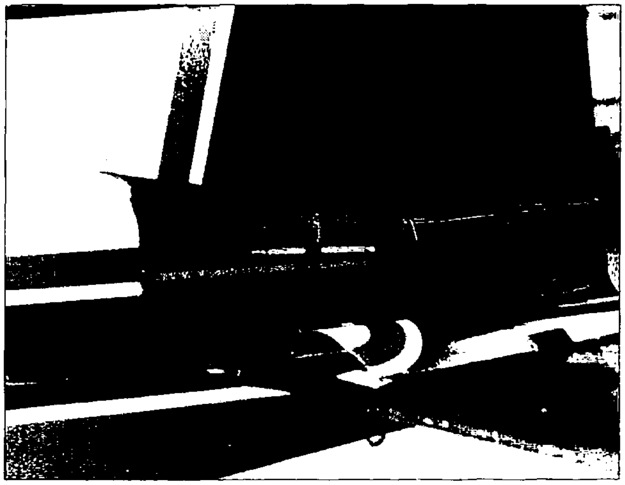


Photo A. There is an Emergency Locator Transmitter (ELT) inside the tail of almost every aircraft. When one starts transmitting for any reason, quick action is needed. (Photo by Tom Curlee WB6UZZ.)

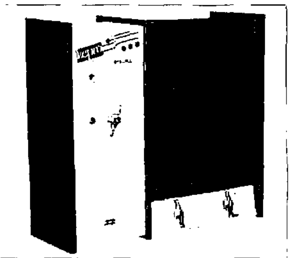
Number 48 on your Feedback card

NEW PRODUCTS

IT'S RAD, ALL RIGHT!

Kenwood Communications Corp.'s "RadCam" is the first camera to allow images to be sent over two-way handhelds! It uses a new digital camera and can work with virtually every major brand of radio. It captures, stores, and displays up to 10 still images in standard digital format and then transmits the images to one or more recipients. The image is received on a radio connected either to another RadCam or to a computer, where it can be stored and printed. It can also upload images directly to a computer.

The radical (Model VC-H1) is an all-in-one unit that includes a detachable camera and a color thin film transistor LCD display, with a built-in microphone and speaker (or optional speaker-microphone accessory). It connects to Kenwood transceivers by a single cable, included with the unit. There's lots more exciting stuff, and you can learn it all by contacting Kenwood at P.O. Box 22745, Long Beach CA 90801. Call (800) 950-5005.



INVITE HER TO SEE YOUR ETCHINGS

Half an hour should impress her—and that's all the time it takes to use the new Kepro BTE-302 glass bead etcher. With a minimum amount of chemical, you can accomplish fine-detailed etching of up to 12-inch square panels. Usually work of this quality demands much more expensive equipment, but the BTE-302 is affordable for hobbyists, schools, and small businesses. To find out just how affordable, contact Kepro Circuit Systems, Inc., 3640 Scarlet Oak Blvd., St. Louis MO 63122-6606. Call (800) 325-3878; FAX (314) 861-9109; or check out the Web site at [www.kepro.com].

1999 EDITION NOW AVAILABLE

The *ARRL Handbook for Radio Amateurs* is in its 76th edition, revised and updated (as it is every edition) to maintain its reputation as *the* reference standard for amateur radio operators, engineers, technicians or students.

The 1999 *Handbook* contains all the explanations, projects, and reference materials you've come to expect, plus new higher-tech projects and templates, and some of the free software (downloadable from ARRL's Web site) has been enhanced.

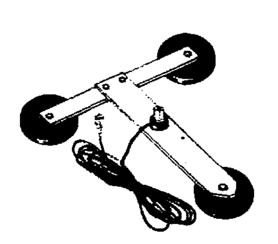
The 1999 *Handbook* is priced at $32.00 US, and copies are available (order ARRL #1816) from ARRL Publication Sales, 225 Main Street, Newington CT 06111-1494; call (888) 277-5289; FAX (860) 594-0303; or see your dealer.

PROTECTION FROM ABOVE

Well, it's only reasonable, when disaster strikes from above. The MFJ-270 *Guardian Angel™* lightning surge protector will safeguard your expensive radio equipment from devastating lightning-induced surges traveling down your 50Ω coax. Then when your neighbor's rig gets fried because he was too cheap to invest a measly $29.95, you can murmur sympathetically while you hide your smirk—because you knew that the MFJ-270's ultra-fast gas discharge tube safely shunts up to 5000 amps of peak impulse current harmlessly to an independent ground connection.

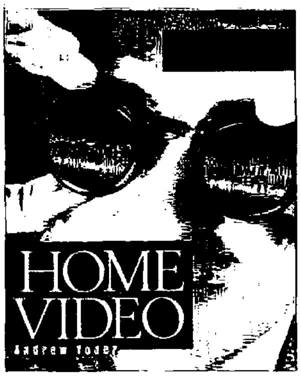
The MFJ-270 does not protect against a *direct* lightning hit—but do you seriously expect miracles?

See your dealer or call (800) 647-1800; FAX (601) 323-6551; or write to MFJ Enterprises, Inc., 300 Industrial Park Rd., Starkville MS 39759.



STICK ON YOUR HAMSTICK

Lakeview Company, Inc., maker of Hamstick antennas, now sells the Tri-Magnetic Mount (Cat. #375) with all stainless steel hardware. The 375 holds all Hamsticks and lots of other antennas with three black powder-coated magnets—over 400 pounds of holding power—in a 12-inch by 14-inch footprint! Eliminate rust on your magmount for only $39.95. It's also available with an NMO and SO-239 configuration for an additional $5.00. For more information, visit your dealer, or to order, call (864) 226-6990 or FAX (864) 225-4565 Monday through Friday 8 a.m. to 4:30 p.m. EST. Mail orders (add $7.00 s&h) should be sent to: Lakeview Co., Inc., 3620-9 Whitehall Road, Anderson SC 29626.



FOR HOME THEATER BUFFS

Andrew Yoder, whose name you may recognize from his previously published books, has written a new one: *Home Video*, subtitled *Choosing, Maintaining, and Repairing Your Home Theater System*. And it's a doozy. These 339 easy-to-understand pages contain everything you'll need to know about home video, including how to cannibalize old electronics equipment to build your own home theater from scratch! If you're into cocooning, expecting a very long winter (nuclear or otherwise), or ready to remodel your home to include a fully-equipped entertainment suite, pick up a copy ($39.95 hardcover, $24.95 paperback) of Yoder's *Home Video* wherever TAB (McGraw-Hill) books are sold.

Homing In

continued from page 47

attention to detail helped him perform a useful public service at Long Beach Airport last June. "I had never planned to do anything but recreational hunts and perhaps catch a jammer or two," he wrote, "but I guess you're right when you talk about using RDF for other useful purposes.

"The parking lot at my work site is directly adjacent to the airport," John continued. "I had just left work and was casually tuning in to the control tower on my Kenwood TH-79. I heard a strange noise as I spun the dial around. It was coming from the ELT frequency that I had programmed in a long time ago. The signal was full-scale on the S-meter.

"I removed the HT antenna and couldn't hear the signal that way. I drove out of the lot and down a road where several small aircraft were parked and still heard nothing. I put the antenna back on and noticed that it was much weaker. At that point, I was shielded by a large metal building to the south. As I turned around and came out from behind the building, the signal came up. That told me it was at the same side of the airport as I was, and to the south of me.

"With the antenna off again, I drove down another road that connects several aviation businesses. It was briefly audible without the antenna as I passed a fence with a couple of aircraft parked alongside, but disappeared as I continued. I drove back and parked near the fence where it was loudest. As I started to walk toward the fence, someone came out of the business to see who was parking. I told her that I had heard an ELT and thought it might be from one of the aircraft nearby. She let me into the hangar, but none of the planes inside were the source. As I continued out the back, the signal picked up in strength. As we approached the first of the aircraft parked outside along the fence, the signal went to full scale. As the owner went inside for the keys, I tuned several kHz off and held my HT up to the ELT antenna. There was a full-scale reading with no antenna on my HT.

"After unlocking the aircraft, the owner fiddled with a yellow box inside. The signal disappeared. It turned out that the ELT was normally connected to some interior panels, which presumably held the sensors. The panels had been removed for some reason and the sensors unplugged, setting off the ELT. Somewhat chagrined, the owners of the business thanked me and I went on my way. The whole thing was over less than 15 minutes."

It's typical for agencies like CAP to provide special RDF sets to their members for ELT tracking. When an ELT comes on the air, each member has to find his or her RDF set (*Where is that thing, anyway?*), set it up (*Darned batteries are dead again!*), and drive to a place where he or she can hear the signal. That takes valuable time. So it's great when someone like John can instantly act upon detecting an ELT signal with nothing more than a handheld. Good work!

***Photo B.** J. Scott Bovitz N6MI took the shortest time to find four foxes, but he needed to cool off afterward. Jay Hennigan WB6RDV looks on. (Photo by Joe Moell KØOV.)*

Showdown in Hungary

As I write this, Team USA is en route to Nyiregyhaza, Hungary, for the Amateur Radio Direction Finding (ARDF) World Championships. This year's event takes place in early September at the *Bessenyei Gyorgy* Teachers' Institute, 150 miles northeast of Budapest. It is bringing together the best on-foot foxhunters (also called foxtailers and radio-orienteers) from more than 20 countries. During the week-long festivities, there will be two strenuous ARDF contests on successive days, one on 80 meters and the other on two meters.

Three members of Team USA got a dress rehearsal for the championships at a realistic two-meter ARDF practice session that I hosted in Hacienda Heights, California, on the first weekend of August. It was open to everyone who wanted to try the sport, experienced or not. Several RDF sets, both self-contained receiver-antenna units and add-ons for ordinary handie-talkies, were available for loan. Team Captain Dale Hunt WB6BYU of Yamhill, Oregon, participated, as did Team Member Marvin Johnston KE6HTS and Team Trainer Dennis Schwendtner WB6OBB. Other members of the US delegation to the championships were unable to attend.

Despite temperatures in the 90s, everyone had a great time. Eighteen persons took to the course, attempting to find six transmitters (called foxes or Ts) on 146.565 MHz. Each one came on the air for 60 seconds at a time, one after another, in numbered order. Most foxhunters went out alone, but there were also a few pairs and trios. Teaming is not permitted in formal championships, but was allowed here because it is an excellent way to teach RDF techniques. WB6OBB was assisted by Extender Jay Hennigan WB6RDV. Dennis would not be allowed to officially compete in Hungary, because International Amateur Radio Union (IARU) rules presently forbid assistance for blind persons on the course.

International championship hunts have five foxes and a time limit of 100 to 140 minutes, depending on the course length, as determined beforehand by the judges. Anyone who does not return to the start/finish line within this time limit is disqualified, no matter how many foxes he or she has found. For this session, however, there were six foxes and no time limit. Hunters could stay out longer, for extra practice. They had the option to seek all six foxes if they wished.

Transmitters were placed in accordance with standard guidelines for IARU foxhunts. None were buried or concealed inside a covered object. Registering punches were readily visible to sharp-eyed observers, either at ground level or eye level. All foxes were within the boundaries of the nine-by-12-inch topographical orienteering map carried by each hunter or team. The map included most of Schabarum Regional Park and part of the Powder Canyon Wilderness Area.

In accordance with IARU rules, all foxes ran the same power level (0.75 watts) into identical antennas (quarter-wavelength vertical whips). Regulators in the foxes kept their RF output power constant through the hunt, compensating for battery voltage sag. The only departures from Euro/Asian-based IARU rules were the use of FM instead of AM tones and vertical instead of horizontal polarization. This made it easier for hams who used RDF sets with switched dual vertical whips.

The easiest fox (T1) was at the bottom of a chain-link fence near the park stables, 540 meters east of the starting point. The hardest (T5) was in the base of a tree in the thicket adjacent to a fire road 1.9 km southeast of the start. Elevation of the foxes ranged from 480 to 990 feet above sea level. The start point

Number 51 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[ke8yn@juno.com]

As I'm preparing this column, the smoke from the wildfires here in Florida has only recently stopped being the prevailing aroma. Naturally, amateur radio played a significant support role in the firefighting and relief efforts both in the areas threatened by the fires and in the surrounding counties. In the meantime, hurricane season is in full swing, with three named tropical storms or hurricanes currently on the map—one building, one approaching the coast, and one dissipating over Texas. As a Skywarn coordinator, I'm talking to the weather service on a regular basis. They expect the storm to turn north and miss our area. However, Disaster Services has to prepare for the worst and has decided to begin preparing some of the special needs shelters—just in case—so I'm talking with them regarding possible duties, as area hams have been put on alert to provide shelter communications. As amateur radio operators we have a duty to our community, and sometimes we have to pay up, big time.

With all this going on, I obviously have been pretty busy and haven't had a lot of time to prepare an in-depth construction article or a scholarly review of mobile trends. I have had the time to see a lot of our concepts in action, and have thought of things which are now on my to-do list, and maybe should be on yours, too.

During the Florida wildfires, trained firefighters from all over the country came to assist. Even though these were accomplished professionals, there was the need to provide information (at the least) or training on some of the peculiarities of firefighting here. For example, did you know that a tree falling over during a forest fire makes no sound? Some people wondered why there wasn't greater reliance on the National Guard, but those who were used needed to be given a crash course in forest-firefighting by the US Forest Service. If trained firefighters and the National Guard, both of whom train regularly, recognize the need for mission-specific training, why do many amateurs feel that by breathing and having a radio they'll be ready to face any contingency? To quote one of my instructors when I was just a young pup, "You're good, but you're not *that* good!"

At the same time, of course, we had lost two American embassies to terrorist attacks and had taken military action in Sudan and Afghanistan. As expected, reprisals against Americans have been threatened, possibly even here in the United States. What could this mean to us?

You've probably grown tired of me recommending that you work closely with the agencies you expect to serve long before an emergency occurs. However, most hams have no experience,

---

was at 620 feet. You can see all fox locations and an aerial photo on a special page at the "Homing In" Web site.

Was it too hard?

Nobody found all six foxes, but that's not as bad as it seems. The goal was to have two easy ones, two intermediate, and two that were really difficult. T2 and T5 (the hard ones) were accessible from trails, but they were near hilltops deep in the Powder Canyon Wilderness. The horse trails are long and the foot trails are steep in that region. Getting to all six foxes and back in two hours would have required the speed and stamina of an experienced long-distance runner. Unfortunately, no marathoners showed up.

Under IARU rules, competitors in all divisions except Senior (males age 18 to 40) are required to seek only four foxes. Seniors must seek five. It's an important part of strategy at the championships for competitors to carefully select which one(s) to omit. Most hunters wisely chose not to go after T2 and T5. A no-mistakes circuit from start to each of the four lowlands foxes (T1-T4-T6-T3) to the finish was about four kilometers, making maximum use of the horse and foot trails.

Overall winner was J. Scott Bovitz N6MI (**Photo B**), who found the four lowland foxes and returned in two hours, 15 minutes and 25 seconds. Scott is an experienced radio-orienteer, having competed against foxhunters from the US, Canada, Japan and Asiatic Russia in the Friendship Radiosport Games (FRG) foxhunts in Portland, Oregon (1991), and in Victoria, British Columbia (1993).

Less than three minutes behind Scott to return after finding four foxes was Dale Hunt WB6BYU, captain of ARDF Team USA, who flew from his home near Portland, Oregon, for this event. Dale competed at the Friendship Games foxhunt near Tokyo, Japan, last year, where he finished first among all entrants from North America.

Also finding all four lowlands foxes were Marvin Johnston KE6HTS and Scot Barth KA6UDZ, in that order. Both are experienced, having participated in formal ARDF contests at Hamcon-95 in San Pedro, California, and the 1996 West Coast VHF/UHF Conference in Cerritos, California. Scot was overall winner at the 1995 event and Marvin was leader in his age division.

Marvin has organized on-foot foxhunt sessions for the Santa Barbara Amateur Radio Club. Five other individuals/teams found at least one fox.

The field of contestants included two members of the Los Angeles Orienteering Club, each experiencing foxtailing for the first time. ARDF is similar to classic orienteering because it takes place in the woods with orienteering cards, punches, and maps (see "Homing In" for June 1998). In both sports, it's best if the participant carefully plans a course to cover the maximum number of controls (or foxes) in minimum time. If you are looking for potential radio-orienteering stars in your area, the nearest orienteering club would be a good place to start.

By the time you read this, the 1998 ARDF World Championships will have concluded. Check the "Homing In" Web site to find out how Team USA performed. Think you could do better?

Start training now and plan for practice events in your own area. Perhaps we'll see you at the next multi-nation foxtailing championships. Next year, there will be one here in the US.

The Friendship Amateur Radio Society (FARS) of Portland, Oregon will host radio-athletes from the US, Canada, Japan and Asiatic Russia for the sixth biennial Friendship Radiosport Games during the second week of August 1999.

FARS is seeking approval to expand this get-together into the first IARU Region 2 (North and South America) ARDF Championships. Watch for more FRG-99 news and announcements here.

QRP

Low Power Operation

Michael Bryce WB8VGE
SunLight Energy Systems
955 Manchester Ave. SW
North Lawrence OH 44666
[prosolar@sssnet.com]

No matter how complex a piece of electronic equipment may be, it's still a collection of smaller circuits. By wiring everything together, you end up with perhaps a guidance system for a missile or a 38 Special. In our 38 Special, some of the circuits perform double duty. The product detector, for example, is used as the transmit mixer, too. A design like this allows you to reduce the overall number of components in a project—but it also makes troubleshooting a bit tougher!

A case in point is the now somewhat goofy receiver mixer in my 38 Special. As I told you last month, the output of the receiver mixer was way below the level needed for proper injection into the IF section. Although the mixer was in fact oscillating, there is not enough output to do any good. It's one of those cases in which the circuit works, but does not work correctly.

The revenge of the oscillator from hell!

If you have been following this column for the last several years, you may recall the "oscillator from hell" column. In a nutshell, I had a circuit that was supposed to oscillate like mad, but did not. To make matters even worse, everything was wired correctly and the circuit contained brand-new parts. Now, this receiver mixer comes along and guess what? It won't work like it should.

After a few hours of looking for bad solder joints and misplaced components, I decided to have another look at the output of the oscillator with my scope.

As before, I could see the NE602 was, in fact, oscillating. Pushing in the "magnify" button on the scope's time base showed a lot of critters growing on the sine wave. I then coupled the output of the NE602 to my counter. Much to my surprise, the counter did in fact show the mixer running at 22.118 MHz. The only trouble was that the display was less than rock solid. It moved around a bit. This indicated to me that there were in fact critters riding on the output. But where were they coming from?

To better understand what was going on, I decided to build the receiver mixer on my protoboard. I deleted VXO components such as the 4.7 µH choke and the 1N4004 diode.

If you've never worked with the NE602 oscillator/mixer chip, a word of warning: They will fry if you put more than eight volts on pin 8 of the chip. Make sure you have a 0.1 cap on the Vcc pin (pin 8) to decouple any RF to ground. Keep your leads short and direct. Unwanted inductance will mess things up when trying to use the NE602 on a protoboard.

I ordered a new crystal from Mouser Electronics for use in my protoboard latchup. For good measure, I ordered several rocks at 22.118 MHz. They're a standard computer crystal and are only a few bucks a pop.

With my latchup running on the protoboard, my scope showed a rock solid (sorry!) output from the NE602 and the 21.118 MHz rock. However, the output level was not close to the 1.2 Vpp output at pin 7 of the NE602. The output did have much more bang than the circuit running on the 38 Special board, however.

I decided to take a closer look at the circuits the receiver mixer was feeding. To isolate the CD4066 analog switch, I removed C11. This uncouples the output of the receiver mixer from the 4066. Once again, the scope showed a rather wimpy output level.

Getting desperate, I removed the CD4066, thinking that the chip might be loading the output down via the IF filter. I installed a new CD4066 and the results were the same. I could

Continued on page 53

---

little or no training, and very little notion of what demands a terrorist attack might place on us. Naturally, there would be the usual support for shelters. However, any work with the enforcement agencies or the military could be quite different. In some areas, those who work with the police department undergo a background check and are issued an identification card. During a terrorist situation, police and other agencies would be very hesitant to allow access to anyone who had not been thoroughly checked out. Don't be surprised, in the wake of a terrorist act, if a police official is unwilling to accept (or officially forbidden from accepting) an ARES or RACES card as proof of identity or need for access to a particular area. As usual, the time to plan is well in advance of the situation, not once the situation presents itself.

Potpourri (French for "small items which cannot be a complete column no matter what I do")

•Why isn't there more interest in portable packet? As computers continue to develop, more 286, 386, and 486 laptop computers are showing up at bargain prices. Often when we talk about portable or mobile operations we tend to think of FM, SSB or CW, yet modes such as packet lend themselves very well to portable operation. A laptop computer, even an early one like the Tandy 100, or even some palmtops can be connected to a handie-talkie to provide packet in a hotel room or even a camping tent. Although a TNC is normally required, there are some software packages that use sound boards to handle the translation of audio to digital and vice versa. I know some folks are running APRS this way, but haven't heard much about regular packet. Let me know if you are.

•While operating HF mobile, I usually note contacts in local time and convert the times later. Since small digital clocks are so inexpensive, I'm going to find one that has 24-hour format, set it for UTC and hook it to my dashboard with Velcro®.

•I've seen ballpoint pens with built-in flashlight sold in office supply stores. What a great idea for use in the car after sundown. No fiddling with dome lights or map lights and no interference with night vision!

•External speakers can make a handie-talkie much easier to hear in a car, but sometimes there's no convenient location for a speaker. Once again, a little Velcro can go a long way for mounting a small lightweight speaker.

•When working disaster relief off the beaten path, a compass can be a major advantage. I'm going to add to my "grab bag" one that is large enough to read easily.

These ideas can be reworded and written in your own handwriting for a Christmas list. It should give the spouse or kids some ideas in lieu of the socks and neckties. And remember, if all else fails, every ham can always use one more battery pack for the HT! 73

QRP

continued from page 52

see this was not going to be an easy project!

Once again, while I had the desoldering iron hot, I installed an 8-pin socket for the NE602 chip used for the receiver mixer. Although a socket is not desired in this location, the added lead length may cause unwanted inductance to rear its pesky head. I figured a few more chip swaps would surely destroy the PC board's foil pattern.

A good dose of denatured alcohol was used to clean up the PC board. All that desoldering and solder flux made a mess of things on the board. With the now cleaned PC board, I gave it the once-over one more time, just to be sure that there were no stray whiskers of solder shorting out some pads.

I checked the output of the product detector, too. It's a carbon copy of the receiver mixer, more or less, and it's working just fine. I don't have 1.2 Vpp, but there's more than ample drive coming from the NE602 to drive Q1.

A short detour

Since I had the desoldering equipment running, I replaced the PA stage, the 74HC240, with a new chip. The reason for its replacement was simple. It got so hot it caused a finger burn. By the way, you must replace the 74HC240 with a 74HC240. The 74HT240 won't do the job. Mouser has these chips in stock and they are less than $2 each.

And since I was in the neighborhood, I also installed a new power FET. I surmised that if the 74HC240 was cooked, it was a good bet the FET was toast as well. Remember, this rig had the high power modification put in. The 74HC240 drives the power FET to 3+ W on 10.100 MHz.

Still no go from the receiver mixer

After I have replaced all the parts with the associated circuits, I still do not have a working 38 Special. Once again, I am stumped as to why the oscillator does not work like it should.

As I was working on this rig, I did notice something odd. If you placed a finger near the wires leading to the main tuning control, the output of the receiver mixer changed. It changed both in amplitude and in frequency. That's something that's not supposed to happen.

With the scope once again monitoring the output of the oscillator, I could grow critters on the sine wave by moving my hand near the main tuning control. This explains the junk on the signal, but I still don't know why touching a wire should cause the oscillator to go to pot.

The control voltage generated by the main tuning pot is used to forward bias the 1N4004 diode. This causes the diode to change its capacitance. And, by the way, you must use a 1N4004 diode here. A 1N4001 or similar will not work. For some reason, there's RF getting back into the VXO circuit. So, right now, I'm in the process of ordering a new 4.7 μH choke and VXO diode. That's about the only thing I have not replaced in the entire receiver mixer circuit!

I even went so far as to scope the power supply bus. If you have a 7808 regulator that's making a lot of noise, perhaps that's the reason for some of the junk appearing on the receiver mixer's output. Alas, the regulator's output is nice and clean. No trouble here.

Time for a rest

After working on the 38 Special off and on for a month, it's time to give it a rest. Seems the more I look, the less I see. Right now, this one's got me beat. It's so simple that perhaps I'm just overlooking something. I guess this may be a case of, "Sometimes you're the windshield, sometimes you're the bug!" On the other hand, I've not yet thrown the rig up against the

Continued on page 55

CARR'S CORNER

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Receiver accessories: Do you need them?

There are a number of different accessories that can be added to a communications receiver to "make it better." Or do they? Some of them are built-in options that you can obtain from the original equipment manufacturer. Others are aftermarket or home-brew add-ons that come from a number of different manufacturers.

So do you need them? The answer is an unqualified "It depends!" Sorry for the waffling, ambiguous answer, but it's really a case of the situation, what you are trying to accomplish, and a host of other things.

IF filters

The IF filters for your receiver set the bandpass of the IF amplifier, and therefore set the selectivity characteristics of the receiver. The bandwidth and shape factor of the filter are of interest in improving selectivity. The bandwidth should be matched to the modulation mode being received. For example, CW might use 250 to 500 Hz filters; RTTY: 1.8 kHz; SSB: 2.3 to 3 kHz; and AM: 4, 6, 8, or 10 kHz.

I own a Drake R-8A receiver, which came equipped with 500 Hz, 1.8 kHz, 2.3 kHz, 4 kHz and 6 kHz filters on board. I can match the filter to the mode and conditions. For example, I would normally use a 2.3 kHz filter for SSB, but under some circumstances, where the band was particularly ragged, I might switch to 1.8 kHz and accept the reduced clarity for less QRM.

In general, the rule is really simple: The narrower the bandwidth, the less the noise. On AM reception, which I used for the international broadcast bands, I prefer listening with the 6 kHz filter because it has better fidelity. But the normal case is that those bands are quite crowded, so the 4 kHz filter is more reasonable. I tend to use the 6 kHz filter on the AM BCB, however.

Extra IF bandpass filters are almost always a reasonable thing to buy for your receiver (even though quite costly).

Audio filters

Audio filters are sometimes used to provide narrow bandwidth for eliminating unwanted signals. The first one I saw was a World War II surplus outboard device that was used on B-17 bomber "Command Set" receivers. It was an L-C filter that passed a narrow band of frequencies around 1,050 Hz, and was used for copying CW signals in the presence of lots of other signals. Modern versions are designed around either L-C filters (often with selectable bandwidths) or operational amplifiers ("active filters"). Even if you have some pretty good filters in the receiver, an external audio filter is often a help in working crowded bands.

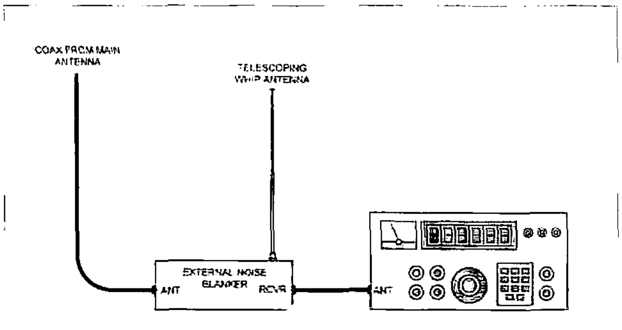


Fig. 1. Using an RF noise blanker.

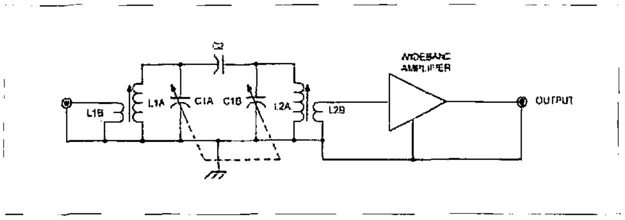


Fig. 2. Preselector schematic.

Antenna noise eliminator

One of the nasty things about listening to shortwave, especially in the 160-meter, 75/80-meter, and 40-meter (plus mediumwave broadcast and "tropical") bands, is the rather raucous noise level from power line harmonics. Normally, you would not expect much problem from the harmonics of a 60-Hz source when listening to shortwave bands. After all, there's a lot of distance between, say, 5,000 kHz and 60 Hz. But there are a couple of problems with that argument (not the least of which is experience ... go listen to it!).

First, the high powers (kilowatts) mean that harmonics are proportionally stronger. Second, high voltage corona and arcing can cause RF noise. Third, even at 120/240 volts, loose connections, appliances, dimmers and a host of other things will cause RF noise. It goes on *ad nauseam*.

One solution is to use an external RF noise blanker (**Fig. 1**). Several such circuits have been published in ham magazines over the years. Most of them work by sampling the local RF environment on a whip antenna using either phase shifting or inverting the sample, before combining it with the signal from the main antenna. The inverted and noninverted versions of the noise signal are combined and cancel each other out, leaving the signal from the main antenna. MFJ Enterprises, Inc. [P.O. Box 474, Mississippi State MS 39762; (601) 323-5869 (voice); (601) 323-6551 (FAX); (800) 647-1800 (orders only); Web site: (http://www.mfjenterprises.com)] has a product based on this idea. Their Model MFJ-1026 eliminates locally generated noise before it reaches the receiver. It looks like an active antenna (which it can also be used as), but plugs in the line between the "real" antenna and the receiver's antenna jack. It cancels noise in the signal that matches the noise picked up by its little whip antenna.

Antenna tuning units

Antenna tuning units are generally not needed on receivers if the purpose is to match impedances. Reception is a lot more tolerant of mismatch losses than transmission (which can be damaged by VSWR), so there is usually little need to match the impedances. The insertion loss of the ATU is about the same magnitude as the mismatch loss without the ATU, so why bother?

Why bother? That's a good question. There is a use for receiver ATUs that is quite handy: prefiltering. If your receiver has to contend with too many too-large signals, or if it has a marginal third-order intercept or dynamic range specification, then performance can be enhanced if

Continued on page 55

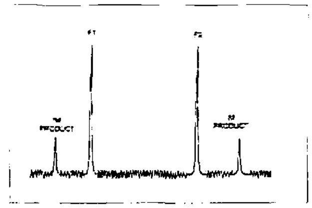


Fig. 3. Mixed signals in a nonlinear circuit produce IM products.

an ATU discriminates against a strong, unwanted signal.

Preselectors

A preselector might be either active or passive. **Fig. 2** shows a circuit that can be used as either. The preselection is provided by the tuned circuit, while a wideband amplifier (such as a low-noise MIMIC MAN-6 or other product) provides gain where needed. The preselector circuit consists of two L-C resonant tank circuits coupled through a common reactance (in this case, the capacitive reactance of C2). Design of these circuits is discussed in the *ARRL Handbook*.

The main reason for using the preselector is shown in **Figs. 3** and **4.** Receivers don't respond in a linear manner to high level signals (of which bands are full). Indeed, the strong signal doesn't even have to be in a ham band to cause problems. Assume in **Fig. 3** that signal F1 is the signal you want to copy, while signal F2 is a strong interfering signal on an off-channel frequency. When the two mix in a nonlinear circuit (such as a receiver front end that's overdriven), a number of spurious intermodulation (IM) products are created. These will be at frequencies described by mF1 ± nF2, where m and n are either integers or zero.

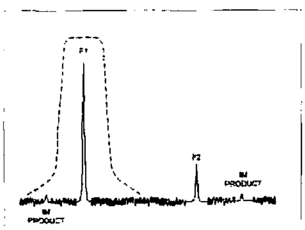


Fig. 4. A preselector can reduce the IM products.

The mixing products that are the worst case are the third-order difference signals. The third-order products are 2F1 + F2, 2F1 - F2, 2F2 + F1, and 2F2 - F1.

Of these, the difference versions are the nastiest. Let's consider two cases. Suppose you want to copy a signal on 14.220 MHz, and there is a strong loudenboomer carrier at 14.240 kHz. The third-order IM products are 2F1 + F2 = 42.68 MHz; 2F1 - F2 = 14.20 MHz; 2F2 + F1 = 42.70 MHz, and 2F2 - F1 = 14.26 MHz.

Of these, the difference products are the most bothersome because they fall in the same band as the desired signals. These are shown as "IM products" in **Figs. 3** and **4**.

But look what happens if the receiver is equipped with a preselector (**Fig. 4**). It will attenuate the undesired F2 signal, and that may drop the overall signal level hitting the receiver below the point that drives it into nonlinearity. As a result, the IM products are reduced as well ... possibly into the noise level.

So do you need the amplifier? Or what about any preamplifier? The answer is simple: It depends. Sighhh ... I know that's not very satisfying, but it's true. The general rule is to look at two factors.

First, does the noise situation improve? If the preamplifier is a very low noise amplifier, then it could conceivably improve the noise performance of the receiver. But if it adds too much noise, then forget it. It will actually hurt you.

Second, does the extra gain put signal levels at the point where they overdrive the receiver? I saw a report from G-land where an amateur had two 20-dB gain two-meter preamplifiers ahead of his receiver. He reported to another amplifier that the poor guy's signal was appearing on two or three spots on the dial. The "problem" disappeared when the rebuking amateur disconnected those darn preamplifiers. So, it depends ... on whether you need the gain and can tolerate it! 73

QRP

continued from page 53

north wall in the basement. And that's an accomplishment!

I think I'll check my safe deposit box. Maybe someone put the Hope diamond in it.

Next month, I'll show you some simple audio amplifiers you can build. It seems that the audio section of most QRP transceivers is usually lacking in performance.

I welcome your input and questions regarding low-power ham radio. Send me your comments, good or bad, at the address at the top of the page—or if you want a faster response, use the E-mail address, also shown at the top of the page. 73

LETTERS

continued from page 6

The construction was spread over half a week. I took Ramsey's advice and did not install a jumper that would have boosted the power output. The initial checkout was approached with the same anxious anticipation of old. Would it work, smoke, or melt? Fortunately, it worked perfectly right off (a personal best for me for a project of this size). After installing the board in the case supplied by Ramsey, I connected the unused tape output leads from my primary hi-fi system to the transmitter, found a quiet spot in the FM band and put it on the air. The only problem was that some RF was getting into my primary amplifier. That was solved by putting a little space between the transmitter and the amplifier and adding some RF shielding to the audio leads. Downstairs in my shop, at the furthest point from the transmitter, I tuned in to my new station and had perfect reception. It also worked equally well in my den. Now, I have music playing all through the house, and on Saturday mornings during the Metropolitan Opera season I can listen to the opera without missing a note when I move about the house. What a blast! The FCC is unlikely to bother me. Testing range resulted in a good signal for a radius of 25 feet outside the house and no useful signal at 100 feet. I also chose an even-numbered frequency to lessen interference.

Now for the Ramsey TV camera and transmitter!

If you're getting the Damark© mail-order catalogs you've seen the 200-CD players selling for around $250 with a remote control (call 800-827-6767 #B-64781-640699). Great source for such a mini-broadcast system. That'll play music for a week, night and day ... Wayne.

Roger Sellers N5EEA. Whew! It's all over now. If you were there, you know it was a fun and interesting meeting full of unique topics and discussions. For me, it was one of the most interesting RARA meetings I have attended. On September 17, I had the pleasure to coordinate Rockford Amateur Radio Association's hosting Wayne Green of *73 Magazine* for the club's September meeting. It was an interesting day of discussions. Chuck Gooden N9QBT and I met Wayne Green and his wife Sherry at O'Hare Airport in Chicago and drove them to Rockford. The two-hour ride back was great and Wayne gladly answered our questions and filled the time with some very interesting anecdotes. I don't think there are too many of us who wouldn't like that opportunity. He has a very humorous slant on life, the computer industry, and aspects of amateur radio. His insights and opinions, based on his years of opportunities and experiences,

Continued on page 56

LETTERS

continued from page 55

were terrific to hear. There are not too many people I have met who have experienced as many things. His comments were certainly thought-provoking. His answers to some of the questions were insightful, and at times controversial. But I think he enjoys those most. He encourages people to expand their capabilities, to take risks, to think for themselves, and even question what is commonplace. He seemed to me not to perceive himself as anything special or out of the ordinary as a person, just someone who takes the initiative and acts rather than sitting back and hoping someone else will do it.

Wayne spoke for about 45 minutes on some of his experiences in amateur radio, computers, and business. He then took questions for about 45 minutes. The questions ranged from his opinion on ARRL actions and the future of amateur radio to obscure health studies, or esoterica, such as the size and shape of the universe. He constantly encourages readers of his magazine to read about other things besides amateur radio, and our club meeting was no different. Based on some of his answers, he clearly has done what he encourages others to do.

We had a number of guests from around the area who attended the meeting. Paul Larson KB9MCX of the Belvidere Big Thunder Club stated that he'd thoroughly enjoyed the evening. He felt Wayne's comments were at times questionable, but nonetheless, since Wayne was obviously well-read, had maybe a bit better perspective than the rest of us. In any event, he had a good time there. Marc Pichette VA3DRV was passing through the area and came to the meeting. He said he can't wait to get home and tell his club there about being able to attend this RARA meeting.

Sam Williams WB5YNI, who is an instructor at Rock Valley College and is teaching a data communications class, brought the students from one of his classes. The students enjoyed the opportunity to listen to and ask questions. Wayne talked on a number of topics they related to and were interested in knowing more about. A number of Rockford area amateurs were able to attend as well; many were not members of the RARA, but they were still glad we were able to have this event in Rockford.

As the coordinator for this event, I would like to thank RARA for its support and the board members for taking the risk in approving this once-in-a-long-time opportunity. Since the club did not charge for the event and made no money on it, they placed a lot of faith in trying to make my crazy idea happen. It was not done for the club or any single person. There was no tangible or opportunistic effort by the club to recruit members, so the club had nothing directly to gain by sponsoring this. It was done for good will and to promote amateur radio. There is no way I could have had the evening occur and run so smoothly without the assistance of others. RARA was able to sponsor this event and present it free to the attendees. I would particularly like to acknowledge the assistance of several members in making this event possible. Thanks to Sheri Harlan KB9SH, Gene Harlan WB9MMM, Chuck Gooden N9QBT, David Whiteside KB9RGW, John Lawrence N9OTC, Tom Shouler N9VJU, Herb Eckstein K9AMJ, and any others that assisted in making this event successful.

I would also like to thank all amateurs that were able to pass along the information about this event to help it happen. And a special thanks to all who attended: I hope you enjoyed the evening and were glad you were able to make the time to attend.

Lastly, I would like to thank Wayne: You volunteered to make the extra effort to visit with us in Rockford. You had to make changes in your itinerary in order to attend our meeting. In a world where everyone is always too busy to do things for others, and so many people are not as they seem, you teach a great lesson.

You have stated in the past that you support people and clubs that take risks and do things to promote amateur radio. It's refreshing to know that as a publisher, and amateur radio operator, you practice what you preach/write. From a simple idea, we stretched and asked for your assistance; you kindly accepted the invitation without hesitation. You worked with us to make this meeting happen and asked for very little in return. As amateur radio operators, we can all take a lesson from your example. Amateur radio will need more people working together in order to keep our hobby/service growing. The survival and future of amateur radio is bigger and more important than any one person or club. You're a great teacher, leading by example. Thank you for visiting Rockford, and I hope you'll have the desire to do it again in the future.

Aw, shucks, Roger — I had a ball! Thanks for making it all happen ... Wayne.

QRX

continued from page 9

committees in Washington, and Congress gave much time to proposed legislation designed to critically limit amateur radio activity.

In 1911, Albert Hyman chose the controversial Wireless Regulation Bill as the topic for his thesis at Harvard. His instructor insisted that a copy be sent to Senator David I. Walsh, a member of the committee hearing the bill. The senator was so impressed with the thesis that he asked Hyman to appear before the committee. Albert Hyman took the stand and described how the little station was built and almost cried when he told the crowded committee room that if the bill went through, they would have to close down the station because they could not afford the license fees and all the other requirements which the bill imposed on amateur stations.

Congressional debate began on the Wireless Regulation Bill and the little station "HAM" became the symbol for all the little amateur stations in the country crying to be saved from the menace and greed of the big commercial stations who didn't want them around. The bill finally got to the floor of Congress, and every speaker talked about the "... poor little station HAM." That's how it all started.

You will find the whole story in the *Congressional Record.* Nationwide publicity associated station "HAM" with amateur radio operators. From that day to this, and probably to the end of time in radio, an amateur is a "HAM."

From *Florida Skip* Magazine, 1959; thanks to the September 1998 issue of *AARC/OVER*, bulletin of the Austin (TX) Amateur Radio Club, Inc., Lloyd Crawford N5GDB, editor.

Already Have an Oscilloscope?

You won't find a cheaper add-on capacitor tester.

Rodney D. Iwan N4MCZ
8046 Windover Way
Titusville FL 32780

Here's a very simple circuit that will let you measure the values of unknown capacitors ranging in value from about .001 µF to about 3 µF. By modifying some of the circuit parameters and adapting the circuit layout, the ranges can be extended in either direction. The circuit is a simple square-wave oscillator borrowed right out of the manufacturer's handbook. The period of oscillation is primarily determined by the value of the test capacitor and the series resistance of the 56 k resistor and R1.

You don't have to worry about the accuracy of the timebase on your oscilloscope, nor of any of the resistor values. Calibration is ultra-simple: Just insert a capacitor of known value between the two test terminals and adjust R1 so that the period of the square wave viewed on the oscilloscope is 100 milliseconds per µF. For instance, a 0.1 µF capacitor should be set up to display a 10 millisecond period on the scope, a 1 µF capacitor should be set up to display 100 milliseconds, etc. If you don't have a known accurate unit for calibration, just take about 10 0.1 µF units, measure each of them and average the readings that you took. Take the capacitor that measured the nearest to the average reading and install it across the test terminals. Now adjust R1 until one period displays as 10 milliseconds on your scope. When an unknown capacitor is installed across the test terminals, its value (in µF) will be the displayed period in milliseconds divided by 100.

Note that you do get a square wave out with no capacitor across the test terminals. This is due to the stray capacitance in the circuit and does contribute some error to the measurement. When you measure very small capacitors, this error can be excessive. This is what limits the low end capability. By using good construction techniques, you might be able to minimize the error. Keeping any test leads short and widely separated does help. You can increase the usable upper range by decreasing the series value of R1 and the 56 k resistor. If you cut this value in half, the calibration factor will also be cut in half: that is, 5 milliseconds now correspond to 0.1 µF, but you can measure up to 5 or 6 µF capacitors then.

Be careful of polarity if you are measuring electrolytic or polarized capacitors—keep the negative lead on the ground test lead. Also, if you are measuring low-voltage electrolytics, keep the applied voltage to less than 150% of the rated voltage of the capacitor under test. Calibration is independent of the applied voltage. Additionally, a pleasant surprise (for me) was that shorted capacitors are readily found: The output to the scope goes high and stays high.

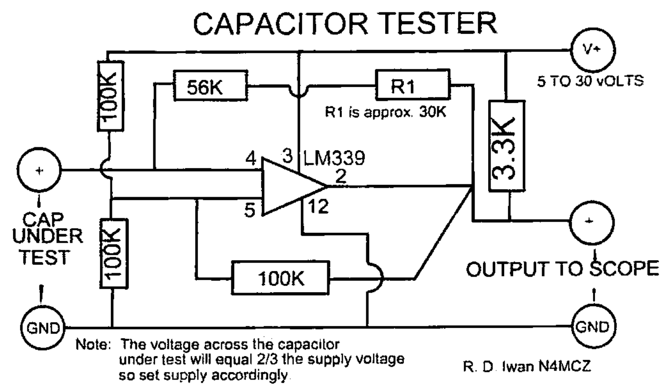


Fig. 1. *Schematic for N4MCZ's capacitor checker. Note: The voltage across the capacitor under test will equal 2/3 the supply voltage, so set supply accordingly.*

NEVER SAY DIE

continued from page 5

was 15. By 16 I was busy making contacts on 40m CW. But it was the frontiers of amateur radio that attracted me. By 1939 I'd built a VHF walkie-talkie. This interest in radio naturally got me into a technical university, Rensselaer. And then, when World War II came along, into the Navy as an Electronic Technician. I volunteered for submarine duty, where I served from 1943–1945. Then they transferred me to the Submarine School in New London, CT to teach electronics.

After the war I went back to college, where I was the president of the radio club and founded WRPI, the campus radio station. Today that's the biggest student activity.

After college I worked as a radio engineer and DJ, then as chief cameraman at WPIX in New York and as a TV director at KBTV in Dallas and WXEL in Cleveland.

I got certificated and worked as a professional psychologist. I worked on a color organ on a Guggenheim Grant, and as the Secretary of the Music Research Institute, where I wrote my first book, *Music For Your Moods*.

But I was more interested in pioneering new ham modes, so when I heard about narrowband FM in 1946, I immediately got on the air with it. That's now the standard for VHF communication.

Oh, God!

There seems to be some genetic need to have a satisfying explanation for things we don't understand. This first led to people ascribing such things to various gods. Then along came the concept of there being just one God. As with any enterprise that offers money, prestige and power, a few people quickly stepped in to use these beliefs to their advantage. Piously stepped in, giving us one commercial religion after another.

The Catholic Church, most of the tenets of which considerably predate Jesus, knew a good thing when they saw it. I'm not sure how many Christian denominations there are, but there's sure no shortage. The Moslems are also split into several, perhaps many, denominations. I almost spelled that demon-ations. The Moslems are as busy killing each other's groups as are the Christians.

Arthur Horn, in his book, *Man's Extraterrestrial Origins*, suggests that ETs are not only genetically engineered man, which helps explain the lack of the famous missing link, but that the ETs set us up to be at war with each other by establishing different languages and religions for different groups. They apparently did this knowing that war is a powerful force for producing progress.

The ETs kept a low profile until we developed the technology to destroy our planet, after which they've been more and more visible. Even our government's best efforts haven't been able to hide their growing presence.

We are able to prove to ourselves the reality of God because we can so often see the results of our prayers. Since it is mainly the God-believers who resort to prayer, the power of wishing something to happen has not been given its proper recognition. Several books I've reviewed recently explain how anyone can use this wishing (prayer) power. There's the last chapter of the latest Dilbert book by Scott Adams, *The Dilbert Future*. Then there's Eugene Maurey's *The Power of Thought*. Both are reviewed in my book guide. Bevy Jaegers also has an excellent book on the subject that I really ought to include in my guide.

The books all explain how you can make things happen by wishing them, with or without any interference or help from God.

It's interesting that when you read the books by people who have interviewed people who have had near-death experiences, there is a general agreement that most people who die come back, reporting that they've gone to heaven and been visited by deceased relatives. Further, they all seem to return with a belief in God, but they tend not to have any further interest in any of the organized religions or churches.

Churches tend to try and control us through fear. God will punish us for our sins, and so on. Complete with a long list of sins and their severity. Control means power and prestige for the anointed, and money. Lots of money.

Scientists and religious leaders have been fighting for power for hundreds of years. They still are. Well, where money, power and prestige are concerned there is always going to be fighting. It's this war which has closed off whole areas of scientific research for scientists. Like the whole idea of "life" after death. You live, you die, period. And all this crapola about near-death experiences, psychics, past lives, reincarnation, telepathy, psychokinesis, precognition, angels, devils, *ouija* boards, seances, and so on is unscientific claptrap. Any scientist who even hints that he's going to venture into these areas is shunned, ridiculed, and made a pariah. He certainly isn't going to get any research grants, nor are his children or his children's children. Nor is he going to get anything published in a scientific journal. If he does discover anything, every effort will be made to make sure that as few people hear about it as possible.

Fortunately there are a few excellent books which help us better understand the link between science and religion. Between what we perceive with our eyes and God. There *are* well-researched books on near-death experiences, out-of-body experiences, reincarnation, past lives (even future lives!), telepathy, angels, and so on. There are even some excellent books on ETs and what they're up to.

The key to tying all this together with the scientific world has just recently been published. And "key" is the right word. This is *The Conscious Universe* by Dean Radin (1997), which I've reviewed recently and is, of course, reviewed in my book guide. I found the book quite by "accident," when I wandered into a bookstore I'd been avoiding for years. This came along at the time I needed it — at the time I was ready for it. Serendipity, as orchestrated by whom or what? I'm beginning to get some clues, thanks to Radin.

And thanks, too, to my grandmother, who, a couple years after her death, guided my mother to Mae Sewall's book, *Neither Dead Nor Sleeping*. The book, written by a world-famous women's rights leader 80 years ago, tells about her communications with her dead husband. Despite its having been out of print for almost 80 years I've reviewed it in my book guide. Now, serendipitously, Lydia Bronte has reprinted it for us. Lydia has a book reviewed in my guide, *The Mercury In Your Mouth*.

Radin leaves no wiggle room for scientists to ignore precognition, or even psychokinesis. He proves, in the language scientists can't ignore, math, that precognition is real. So what? Well, if you'll put on your thinking cap, as Uncle Don used to say, you'll begin to realize that our perception of time is just that, a perception. Once you can deal with that you'll begin to see that though we have no words for it, there is another ... can we call it a universe? ... out there. It isn't "life" after death. Heaven isn't a place. The hereafter isn't either here or after, at least to those who have "passed on." No wonder psychics have a problem communicating with the dear departed! We, on this "side," keep trying to understand the departed on our terms.

The more you read about serendipity and communications with "the other side," the more you understand that the things that are happening aren't always random.

The Sewall book helps explain why so many famous composers and writers have said that their music and words "come to them."

Thus we have the physical world of atoms and quarks, and we have the, er, *something else* which might be considered — like consciousness. And consciousness is able to manipulate matter. Radin shows mathematically that our consciousness can indeed manipulate matter. No wiggle room for skeptics.

People back from near-death experiences report that God is love. But I suspect that's for the lack of a more descriptive word. English may have a lot of words, but it is seriously impoverished when it comes to providing us with words to express feelings.

Heaven is, I suspect, where our consciousness is. How about the term soul? Every now and then some part of our consciousness incarnates, though I'm not sure why. But it's under our soul's watchful "eye," with soul-guided serendipity moving us along, and our soul occasionally appearing as an angel or dealing with us as a spirit guide.

We do seem to have good souls, bad souls, and in-between souls. I'll know more about that when I get over "there" and do some research. Will I be able to go into the future and use a 22nd century word processor?

But the relations between consciousness and matter are gradually being better understood. We're developing more and more ways of communicating with "the other side."

The commercial religious leaders know that this will threaten their power, prestige and revenues, so they're calling such investigations heresy, dealing with the devil, and so on.

The Bad News

An article in *Business Week* pointed out that for the first time the new generation is making less money than the last. 11% less, to be exact. From 1850 to 1950 waves of immigrants arrived, generally starting with low-paying, not very skilled, jobs. Their children were better educated and did better. This was the time when the Industrial Revolution was moving youngsters from the farms to the factories and small farms, which couldn't compete with large ones and were being replaced.

Then came the union movement, which tended to increase the wages for factory workers. But this bubble burst when the cost of international transportation made it possible for workers in less-developed countries to replace our factory workers. There no longer is such a thing as a highly-paid factory worker in America. Worse, the workers in foreign countries not only make lower wages, they now tend to be better educated than American workers.

There's a lot of hype about knowledgeable workers, but not much reality as to how they're turning knowledge into higher wages.

Wages depend on a company's revenues — and they, in turn, depend on making sales. Circulating money in a small community isn't going to increase sales and wages. You have to bring in money from outside the community. And that holds for a town, a state, and a country. So, if we want higher wages nationally we're going to have to sell products to other countries. To do that we have to make them first. And that means factories. So as our factories move out of the country, our overall wages are going to have to reflect this national loss of revenues. I hope that makes sense. And that's what's been happening.

Is there any solution to this downward spiral?

Well, we've been doing pretty well with high-tech products which have innovative new generations coming out before foreign factories can catch up, but that's not a marketing system to bet the country on.

Recycling PCs

There are tons of old PCs and printers out there available at scrap prices. Has anyone figured out anything to do with 'em yet?

The PCs are made up of a floppy drive, a monitor, power supply, keyboard, and the computer board. Most of the old PCs were taken out of service when just one of its elements failed, so by putting the working parts of two or three computers together you should be able to at least provide one working system, even though it may be using an older 386 or 486 chip.

Sure, these are slower, but they'll make very adequate and inexpensive word processors, and can be adapted for any number of applications.

A school or other nonprofit organization could attract an endless supply of these old machines from company storage rooms if the companies could get tax credits for their donations. That's a whole lot better place for them than the company dumpsters.

How difficult is it to update the old motherboards with newer chips? Or perhaps make a new board which could be patched in to update old systems? Hardware hackers should get their ingenuity working and get us some articles. There are millions of old PCs out there, so let's see what we can come up with.

Just look at what happened when the FCC forced taxicab companies to change to narrowband FM systems. We hams bought up their old rigs for

repeaters were spaced 60 kHz apart. Of course it didn't take long before we had so many repeaters that we had to go to narrowband, spacing them 30 kHz apart. Then to our present 15 and 20 kHz. But it was those tons of old GE and Motorola taxi radio systems that triggered our revolution.

Don't just sit there, get your brain working.

Iconoclast

My dictionary defines an iconoclast as someone who attacks conventional or cherished beliefs and institutions as being false or harmful. Hey, that's *me!* I am definitely an iconoclast! And the more I look into things (that's called research), the more I find I'm disbelieving conventional institutions. And yes, these institutions and beliefs are harming us. And they're false. But we've all been hoodwinked (a.k.a. brainwashed, hypnotized) into believing them.

We are taught from the earliest childhood by our parents, our peers, neighbors, and the media to believe in the goodness of mom and apple pie. We're thoroughly inculcated with beliefs that are making us sick, robbing us of 20–30 years of life, and keeping us from making much money.

We believe in our school system. Oh, we know it has some problems. More money might fix them, right? And we believe in doctors. Sure, there are some quacks. We believe in our food suppliers who are providing us with "enriched" and "lite" products, but we're protected by the FDA. Most of us don't believe our government would lie to us about really important things. Of course there are a few conspiracy nuts who are forever trying to make trouble over the Fed, the Illuminati, the National Security Council, the New World Order, and so on. And we have a few atheists who (gulp!) don't believe in God.

Then there are the government coverups such as the UFOs and ETs, and the Amelia Earhart disappearance, which I knew personally about. Were the *Apollo* Moon visits all faked?

We're being bought off with entertainment to keep us too busy to figure things out. How much of your life is spent working, sleeping and being entertained?

Bioelectrimagnetics

Letters from happy builders of the Bioelectrifier keep coming in. It seems able to clean almost any kind of crud from the blood, making short work of the flu and so on.

Magnets, too, are working miracles in easing pain and promoting the rapid healing of wounds. Some veterinarians have been using magnets on animals after surgery and seeing the animals heal in a fraction of the usual time.

Being as able as you to ignore the obvious, it wasn't until a reader sent me a booklet on the subject that it dawned on me that if passing a microcurrent through the blood can do wonders, and using magnets likewise, why not combine the two?

Of course, if you are too busy wasting your life ragchewing about nothing on the repeater or 75m, then you won't be interested in experimenting with the combo to see what it can do. You can get a boost up in the field if you'll at least read a couple of books on what magnets can do. Yes, of course a couple of 'em are reviewed in my book guide. You'll want to know when to use the north pole and when the south. They do entirely different things to you (and to plants, too).

Let's see what you can come up with — and let me know.

Yes, More Y2K Stuff

The information industry's bible, *Computerworld*, is at long last beginning to sound the year 2000 computer problem warning. A recent issue had several articles on the subject, pointing out that finding and rewriting the old code is just one part of the problem. Then comes the testing, which can eat up as much time as the code rewriting. They need to test to make sure they've found *all* of the Y2K bugs, plus make sure they haven't introduced further bugs in the process. Then they need to develop contingency plans should some or even all of their systems stop working on Jan. 1, 2000.

Witness the recent massive mess at the opening of the new Hong Kong Chep Lak Kok airport, where untested computer systems delayed hundreds of planes from landing, thousands of travelers lost their luggage, the escalators froze, toilets overflowed, and perishable goods rotted in the broiling sun, running up damages in the hundreds of millions of dollars.

Just a week before there was a similar debacle with the opening of the new Kuala Lumpur airport at Sepang, where the 19 interconnected computer systems broke down, creating chaos. We had a taste of that when they opened the new Denver airport. Delayed planes, lost baggage, and so on. That's when Continental Airlines gave up and moved their major hub operation out of Denver.

These little snafus give us an idea of the mess that the Y2K could generate — except that it looks as if it could well be worldwide chaos in every industry and with every government.

Even More Y2K

A few weeks ago Senator Robert Bennett of Utah, the chairman of the Senate Special Committee on Year 2000 Technology Problem, gave the keynote talk at a Y2K conference. He went through a long list of the problems facing various industries in coping with the problem, pointing out that even if our major corporations manage in some way to get all of these computer systems Y2K compliant, they still face the very real potential of not being able to get through to their foreign offices and subsidiaries. The telephone systems in South America, Asia and much of Eastern Europe are very likely to be down, making it impossible to send or receive money transfers, handle routine business, or maintain a flow of products. The banks in these countries could also suffer catastrophic failures.

How serious is the Y2K problem? Bennett is right in the middle of it, and he was very frank in saying that he doesn't know whether it's going to turn out to be "just a serious bump in the road or trigger a major worldwide recession with absolutely devastating economic consequences."

January first 2000 is coming and not even an act of Congress can stop it.

Bennett asked, Will the railroads keep running? They're all totally computerized. If they stop, that will stop the coal from being delivered to power generating stations, and without power it doesn't matter whether our computers are Y2K compliant or not. All it might take to grind a railroad system to a halt would be some embedded chip in the system that suddenly thinks it's the year 1900.

The FDA Again

The government SWAT teams are at it again. Wait'll you get a load of this one! This happened in the Dallas area.

Stevia is a safe, natural herb that is hundreds of times sweeter than sugar and has no calories. It's been used for years around the world, and particularly in Japan. A small company in Arlington, Texas, has been publishing books about stevia, including cookbooks, and selling stevia.

The FDA came in and confiscated their stevia and mandated that their books be burned. The arrival of a TV news camera stopped the burning temporarily. It took the threat of a legal suit against the FDA in Washington to back them down.

So what's this all about? It's about protecting the sales of Aspartame®, which is owned by Monsanto. Aspartame is anything but safe and has been linked to thousands of adverse reactions — vision problems, headaches, and seizures. There are several books citing the problems Aspartame has caused people.

The Hep-C Generation

Hepatitis-C is deadly, there's no known effective treatment.

and four times as many Americans have it as AIDS. So how many deaths will it take to get our medical industry to at least test the Bioelectrifier against this new viral blood-system foe?

According to the doctors at the Albert Einstein College of Medicine, passing a microcurrent through the blood prevents any virus, microbe, fungus, yeast, or parasite from either replicating or attaching to white cells, thereby killing it. They even got a patent on doing this, but from then on a blanket of secrecy has cloaked the whole affair. Nothing has appeared in the medical journals.

When Dr. Beck proposed applying the micro-current to the blood stream without removing the blood from the body, the prospective cost for the procedure dropped from tens of thousands of dollars to pennies, a nightmare that the medical industry, with the help of the FDA, NIH, WHO, and other bureaus with thousands of employees diligently working toward their retirement pensions, has been fighting to prevent.

I've run two articles so far on building simple Bioelectrifiers. Hardly a day goes by that I don't get a letter from someone who claims that this device has helped them, with simple things like toothaches and headaches to cancer, lupus, Lyme disease, and AIDS. But this is all anecdotal, and doesn't prove anything. What is needed are some carefully done double-blind medical tests, done by a recognized research hospital.

My thanks to Bill Rose KLØNW for sending me the clipping on hep-C — which featured a photo of Janet Crenshaw at her ham station.

Web Pages

It's about time that some ham publication started providing a list of the Web sites of interest to hams. So, what are you waiting for? Get busy and dump 'em on me via snail- or E-mail [design73@aol.com]. Oh yes, one more thing: How about giving the Web sites a rating as to how interesting you've found 'em? Maybe we can work up a list of the top 10 ham Web sites if we get enough votes to make it valid. You might also comment on how friendly the sites are. Some, obviously done by programmers showing off, take so long to load that the irritation factor outdoes the interest of the site information. "Keep it simple" should be the guiding star.

Okay, I know that amateur radio isn't everything, so how about a list of the five most interesting Web sites of any kind that you've found? With a zillion Web pages out there, we need all the guidance we can get.

Look, the Internet is here to stay (at least until Y2K hits), so let's take advantage of its benefits and integrate it into amateur radio. With the Internet being used for el cheapo phone calls and real audio broadcasting, how soon will it be before we're seeing some repeater-like systems being developed? So get busy and do it, then let's see some articles on interfacing the Internet. Maybe we could treat it like a new ham band with international round tables going on over different channels. Or how about interfacing it with repeaters so I could make some contacts over the Hong Kong repeater, for instance? Or the Swaziland repeater. I've used those when I was visiting, so I'd love to get back in touch with the chaps I met without having to run a kilowatt and a big beam to do it.

I know they're doing video on the Internet, but how about slow-scan?

White House Amnesia

We've been under a steady media smear barrage aimed at special prosecutor Kenneth Starr. It's almost time for the louder of the media mouths to take a look at the evidence. Starr's investigation turned up enough evidence to get more than 20 felony convictions — from a jury made up of the people in Arkansas who elected Clinton governor. Twice. One of those convicted was Susan McDougal, who still refuses to say whether Clinton was in on the fraudulent deal that got her convicted. By the way, Susan is also under indictment for embezzlement in California.

Then there was the felony conviction of Webster Hubble, the hundreds of thousands of dollars that suddenly appeared out of nowhere, and his memory failure when it came time to provide the evidence he'd promised in exchange for a reduced sentence.

How about Vernon Jordan and his amazing good deeds for Hubble and Monica Lewinsky when they became possible witnesses against Clinton? Monica was offered a $90,000 job, despite her inexperience.

Then there was the remarkably serendipitous death of White House counsel Vincent Foster on the day that the first Whitewater subpoena (that led to all those felony convictions) was issued. We also know positively that White House aides spent hours ransacking Foster's office before law enforcement officers arrived to investigate, and this despite their being asked specifically to leave everything alone. Phone records show that those ransacking Foster's office made many phone calls to Hillary Clinton that night, ending after midnight. When called to testify under oath about these calls, none of the aides could remember anything that was said. Mass amnesia had set in.

Amnesia also set in when the White House officials were asked who had hired the White House aide and former bouncer who illegally had the confidential files of hundreds of Republicans in his hands. They also had no memory of why he had the files or what he was doing with them.

Then there are the people from foreign countries who gave huge donations to the Clinton campaign and then either took the Fifth Amendment or quickly got out of the country when questions were raised. The Chinese nuclear missiles that now have American technology to make them more accurate resulted from Clinton's overruling our military experts. The Chinese government has recently boasted that their missiles can now reach our cities. They sure got their money's worth for their illegal donations. Maybe Bill will apologize if the Chinese nuke a few of our cities.

Kenneth Starr has his work cut out for him, with the White House covering things up as fast as they can in every direction he turns, and all the while doing their best to smear him.

Please, please, try to remember my first step in solving many of these problems: Never Re-elect Anyone. NRA.

If you accuse me of stealing a lot of the above information from a Thomas Sowell column, I have no memory of it.

Tubes

You remember tubes, right? I was going through some boxes of books out in the barn and came across my old RCA tube manuals. What a trip through memory lane. I don't think there are any tube manuals these days, but you probably can get answers to your tube questions at [www.svetlana.com].

Back in 1965, when I saw the handwriting on the wall, I organized a hamfest in Peterborough. I rented the local armory and a bunch of tables from churches to lay out all my equipment and parts. We had one heck of an auction, with big boxes of tubes going for a dollar, and all kinds of great surplus stuff going for pennies. I was mainly interested in finding good homes for my treasures.

When I moved from Brooklyn to Peterborough in 1962 it took five truckloads to get it all up here. I'd not only totally filled the cellar of my Brooklyn home, but also four rented neighbors' garages. One truck was so heavily loaded with my equipment that Larry WA2INM, who helped with the move, had to back the truck up some hills to get it here. And when he pulled into the Peterborough gas station and one tire blew out, normal truck jacks just sank into the asphalt so they had to get a special jack. But I wrote about that in 1962 so you

Continued on page 62

Number 62 on your Feedback card

PROPAGATION

Jim Gray W1XU/7
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

Very disturbed geophysical conditions (Poor to Very Poor) are expected from November 1–11, with poorest propagation expected on November 6, 7, and 8 (see calendar).

During this period, you can also expect violent storms and other geophysical effects, as well as ionospheric upsets, on Earth.

Propagation conditions between November 12 and 16, and again between 17 and 21, are expected to be variable, ranging from Poor to Fair. You can expect excellent DX propagation during the period between November 21 and the end of the month, with a slight fade to Fair on the last two days. December will probably start off with Poor propagation.

10–12 meters

Fairly good transequatorial DX should occur during local afternoons. Also, some F2-layer openings on east-west paths to Africa and the South Pacific may be possible in the morning. Short skip out to 2,000 miles or so ought to be available in the afternoon.

15–17 meters

Reasonably good DX to all areas of the world, especially to Africa, South America and the South Pacific during daylight hours and peaking in the afternoon. Short-skip openings to distances greater than 1,000 miles should be common.

20 meters

Expect openings to all areas of the world from morning to evening (see band-time-country chart), peaking locally an hour or so after sunrise and again during the afternoon. Short skip beyond 750 miles should be good during the day.

30–40 meters

Fairly good worldwide DX openings may be expected from early evening through sunrise; short skip from 100 to 1,000 miles during the day, and beyond during darkness hours. As always, QRN can be a problem, but should be abating this month.

80–160 meters

On 80 meters, you may find fairly good DX openings to the southern hemisphere during hours of darkness and sunrise; short skip to about 350 miles during the day, and out to between 500 and 2,000 miles at night. On 160 meters, look for DX during the hours of darkness and just before dawn. Short skip should be available from 1,500 to 2,300 miles at night.

Check the bands above and below the suggested ones for possible DX surprises. It's often a good idea to park your receiver on a seemingly unused frequency and just wait. A DX station is very likely to pop up before any one else hears him, and you can snag a good catch. Smart operators don't try to bust pileups unless they have super antennas and kilowatt rigs. Be smart and wily ... like a fox ... and make your play before the pileup starts. Listen, listen, and listen. 73, W1XU/7.

November 1998

SUN	MON	TUE	WED	THU	FRI	SAT
1 P	2 P	3 P	4 P	5 P	6 P-VP	7 VP
8 VP	9 VP-P	10 P	11 P-F	12 F	13 F-P	14 P
15 P	16 P-F	17 F	18 F-G	19 G-F	20 F	21 F-G
22 G	23 G	24 G	25 G	26 G	27 G	28 G
29 G-F	30 F					

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20					20	20				15
ARGENTINA	20	20	40	40						10	10	15
AUSTRALIA	15		20			40	20	20				15
CANAL ZONE	15	20	40	40	40		20	20	20	10	10	15
ENGLAND	40	40	40	40			20	15	10	10	20	20
HAWAII	15	20	20	40	40	40	20	20			10	10/15
INDIA							20	20				
JAPAN	15	20					20	20				15
MEXICO	15	20	40	40	40		20	20	20	10	10	15
PHILIPPINES							20	20				
PUERTO RICO	15	20	40	40	40		20	20	20	10	10	15
RUSSIA (C.I.S.)	40	40						15	15	20		
SOUTH AFRICA	20								15	15	10	20
WEST COAST	40	80						20	20	20	15	40

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15											15
ARGENTINA	15	20	20	40	40						10	15
AUSTRALIA	15	20	20	20		40	80					15
CANAL ZONE	15	20	20	40	40			15	15	10	10	15
ENGLAND		40/80	40/80			15/20	15	15	20	20	20	
HAWAII	15	20	20	40	40	40	80	20			10	15
INDIA								20				
JAPAN	15											15
MEXICO	15	20	20	40	40			15	15	10	10	15
PHILIPPINES	15	20						20				
PUERTO RICO	15	20	20	40	40			15	15	10	10	15
RUSSIA (C.I.S.)								20	15	20		
SOUTH AFRICA	20									15	15	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	15	20	20	20	40	40				15
ARGENTINA	10/15	20	20	40							15	10/15
AUSTRALIA	10	15	15	20	20	40	40	40	20	20	15/20	15
CANAL ZONE	20	20	40/20	40/20	40			20	15	15	10	10
ENGLAND										15/20	15-20	
HAWAII	10	15	20/15	40	40	40	40	40		20	20	20
INDIA	15/20	15/20							20			
JAPAN	10/15	15	15	20	20	20	40	40				15
MEXICO	20	20	40/20	40/20	40			20	15	15	10	10
PHILIPPINES	15/20	15/20		20		40	40		20	20		15
PUERTO RICO	20	20	40/20	40/20	40			20	15	15	10	10
RUSSIA (C.I.S.)									20			
SOUTH AFRICA	20	20								15	15	20/15
EAST COAST	40	80						20	20	20	15	40

NEVER SAY DIE

continued from page 61

probably don't want to read about all that again.

I sort of hated to see the big bottles go. You know, like the 833As. I still have a couple of 10 kW tuning capacitors out in the barn. No one wanted 'em. *Huge* suckers.

Well, you see, I spent many years at the workbench building stuff and modifying surplus gear. When I needed a capacitor I'd go to Radio Row in Manhattan and buy a dozen or two, just in case. So I ended up with parts cabinets full of switches, tube sockets, connectors, jacks, potentiometers, meters, all kinds of

Continued on page 64

Radio Bookshop

Here are some of the books Wayne has written. Some can change your life, if you'll let them. If the idea of being healthy, wealthy and wise is of interest to you, start reading. Yes, you can be all that, hut only when you know the secrets which Wayne has spent a lifetime uncovering.

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some very difficult changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No. I'm not selling any health products. $5 (H)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (M)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (B)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (C)

The Bioelectrifier Handbook: This explains how to build or buy a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, patented, and then hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (A)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaughts' biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (D)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe us all out are right, we're in trouble. In this book I explain about the various disaster scenarios, from Nostradamus, who says the poles will soon shift, wiping out 97% of mankind, to Sai Baba, who has recently warned his followers to get out of Japan and Australia before December 6th this year. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, or even Y2K? I'm getting ready, how about you? $5 (E)

Wayne's Submarine Adventures in WWII: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? There are some very funny stories, if you're near Mobile, please visit the Drum. $5 (S)

Improving State Government: Here are 24 ways that almost any state government can cut expenses enormously, while providing far better services. I explain how any government bureau or department can be gotten to cut its expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (L)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (T)

Wayne's Caribbean Adventures: More budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. Like the special Liat fare which allowed us to visit 11 countries in 21 days, with me diving all but one of the islands, Guadeloupe, where the hams kept me so busy with parties I didn't have time to dive. $5 (U)

Silver Wire: With two 3" pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (Y)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngsters' IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (Z)

Reprints of My Editorials from *73*.

Grist I: 50 of my best non-ham oriented editorials from before 1997. $5 (F)

Grist II: 50 more choice non-ham editorials from before 1997. $5 (G)

1997 Editorials: 240 pages, 216 editorials discussing health, ideas for new businesses, exciting new books I've discovered, ways to cure our country's more serious problems, flight 800, the Oklahoma City bombing, more Moon madness, and so on. In three $5 volumes. $15 (O)

1998 Jan-Aug Editorials: 188 pages in two $5 volumes. Bringing you up to date. $10 (P)

Ham-to-Ham: 45 of my ham-oriented editorials. These will help you bone up on ham history. Great stuff for ham club newsletter filler. Yes, of course these are controversial. $5 (Q)

$1 Million Sales Video: How to generate extra million in sales using PR. This will be one of the best investments your business ever made. $43 (V)

One Honr CW: Using this sneaky method even *you* can learn the Morse Code in one hour and pass that dumb 5wpm Tech-Plus ham test. $5. (CW)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 wpm or 20 wpm. $5 (T5)

Code Tape (T13): Once you know the code for the letters (T5) you can go immediately to copying 13 wpm code (using my system). This should only take two or three days. $5 (T13)

Code Tape (T20): Start right out at 20 wpm and master it in a weekend for your Extra Class license. $5 (T20)

Code Tape (T25): Same deal. It doesn't take any longer to handle 25 wpm as it does 13. Or use the ARRL system & take six months. $5 (T25)

Wayne Talks at Dayton: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (W1)

Wayne Talks at Tampa: This is the talk I gave at the Tampa Global Sciences conference. I cover cold fusion, amateur radio, health, books you should read, and so on. $5 (W2)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (R1)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (R2)

Elemental Energy Subscription: I predict this is going to be the largest industry in the world in about 20-30 years. They laughed at me when I predicted the personal computer growth in 1975. PCs are now the third largest industry in the world. The elemental energy ground floor is still wide open, hut then that might mean giving up watching ball games and talk shows on the boob tube. $30 for six issues. (EE). A sample issue is $10.

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (K)

......Wayne

Radio Bookshop

70 Hancock Road, Peterborough, NH 03458

Name ______________ **Call** ________ **Phone** ________

Address ______________________________

City-State-Zip ______________________________

Items ordered - use letters or copy page and mark books wanted. Order total plus $3 s/h in US.$6Can.

______________________ US$__________

Foreign orders: $10 s/h surface shipping. Lord knows what airmail will cost – make a good guess. Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

MC/Visa for orders over $10. #______________________ Expire ______

Phone orders: 603-924-0058 • 800-274-7373 • Fax: 603-924-8613

Yes! Put me down for a year of *73* for only $25 (a steal). Canada US$32. Foreign US$44 by sea, US$67 by air. Whew!

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: ***73 Magazine,* Barter 'n' Buy, 70 Route 202N, Peterborough NH 03458** and get set for the phone calls. The deadline for the February 1999 classified ad section is December 10, 1998.

Number 64 on your Feedback card

Ham Help

We are happy to provide Ham Help free on a space-available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double-spaced, on a full 8-1/2 x 11-inch sheet of paper. Use upper- and lowercase letters where appropriate. Also, print numbers carefully. A 1, for example, can be misread as the letters l, i, I, or even the number 7. Specifically mention that your message is for the Ham Help column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Searchin' every whichaway

Desperately need service and technical manuals for Sideband Engineers (SBE) Transceiver model SB-36. Thanks for any help.

Al Cikas KA9GDL
412 Radford Drive
Sherman IL 62684

Gonna find it

Needed: Owner's manual for product labeled Unique Wire Tuner, made by Unique Products Co. (UPC), 1003 S. Fircroft, West Covina CA, approximately 1976. This company also made a product called the Identiminder. Any help much appreciated.

Dick Burke KA1ZQR
348 N. Main St.
Stonington CT 06378

Gonna keep searchin'

I am looking for an audio mod for the Radio Shack DX-394. Mine seems to exhibit a lot of distortion. Any info on audio improvements? All responses will be appreciated.

Rick Aiello
2945 Presbyterian Road
Mt. Morris NY 14510

Never Say Die

continued from page 62

resistors and capacitors. I had so much stuff I could build almost anything without having to get more parts. A Williamson amplifier? No problem. A RTTY control unit? Easy.

Then came transistors and printed circuit boards instead of steel chassis and 19-inch panels. Followed by ICs and soldering pencils instead of 300-watt irons. By 1965 I saw the handwriting on the wall and got rid of just about everything in one massive auction. The ARRL had their national convention in Seattle the same weekend and I had more hams here than they did! I don't think anyone went home empty-handed.

Getting rid of all that stuff cleared out my barn, which I eventually converted into offices for my computer magazines. I've never really missed all that stuff.

73® Amateur Radio Today

DECEMBER 1998
ISSUE #459
USA $3.95
CANADA $4.95

Applying Your Electronic Genius to Cars

Reviews:

Alinco's Incredible DJ-C5 — Wow!

Velleman's Morse Decoder — A Code Whiz Shortcut

Build:

QRPeanut — Easy &

CW Personality Enh

Manuscripts: Contributions for possible publication are most welcome. We'll do the best we can to return anything you request, but we assume no responsibility for loss or damage. Payment for submitted articles will be made after publication. Please submit both a disk and a hard copy of your article [IBM (ok) or Mac (preferred) formats], carefully checked drawings and schematics, and the clearest, best focused and lighted photos you can manage. "How to write for 73" guidelines are available on request. US citizens, please include your Social Security number with submitted manuscripts so we can submit it to you know who.

DECEMBER 1998
ISSUE #459

73® Amateur Radio Today

TABLE OF CONTENTS

FEATURES

REVIEWS

DEPARTMENTS

On the cover: And how many hams out there have visions of *these* two sugarplums dancing in their heads? Photo of ICOM's IC-Q7A and IC-T8A handheld FM transceivers by Norman Marion. Happy Holidays to all!

Feedback: Any circuit works better with feedback, so please take the time to report on how much you like, hate, or don't care one way or the other about the articles and columns in this issue. G = great!, O = okay, and U = ugh. The G's and O's will be continued. Enough U's and it's Silent Keysville. Hey, this is *your* communications medium, so don't just sit there scratching your...er...head. FYI: Feedback "number" is usually the page number on which the article or column starts.

73 Amateur Radio Today (ISSN 1052-2522) is published monthly by 73 Magazine, 70 N202, Peterborough NH 03458-1107. The entire contents ©1998 by 73 Magazine. No part of this publication December be reproduced without written permission of the publisher, which is not ail that difficult to get. The subscription rate is: one year $24.97, two years $44.97; Canada: one year $34.21, two years $57.75, including postage and 7% GST. Foreign postage: $19 surface, $42 airmail additional per year, payable in US funds on a US bank. Second class postage is paid at Peterborough, NH, and at additional mailing offices. Canadian second class mail registration #178101. Canadian GST registration #125393314. Microfilm edition: University Microfilm, Ann Arbor MI 48106. POSTMASTER: Send address changes to *73 Amateur Radio Today*, 70 N202, Peterborough NH 03458-1107. 73 Amateur Radio Today is owned by Shabromat Way Ltd. of Hancock NH.

Contract: By being so nosey as to read this fine print, you have just entered into a binding agreement with *73 Amateur Radio Today*. You are hereby obligated to do something nice for a ham friend—buy him a subscription to *73*. What? All of your ham friends are already subscribers? Donate a subscription to your local school library!

NEVER SAY DIE

Wayne Green W2NSD/1

and maybe answer some questions for you.

At the recent Peoria hamfest one chap asked me if the universe is expanding or not. The preponderance of evidence indicates that it isn't, that it's a steady-state universe.

If you're planning to come it would be most helpful if you'd let me know so I won't try to fit a hundred people in a 20-person meeting room.

How About Skiing?

I'll be skiing at Aspen January 6–11 and I really hate to ski alone. It's a lot more fun to be with some others on those chair rides, and to share the incredible excitement of whooshing down the slopes at breakneck speed. I love it. The English language is the pits when it comes to explaining emotions like that.

And it's fun to go to the many superb Aspen restaurants with friends. And talk. If you can get away for a few days, this is the low season time at Aspen, right after the New Year's holidays, so the slopes are relatively open and the lift lines normally zilch. I hope the weather cooperates. Last year it snowed all but one day during my visit, which took the fun out of it, reducing the visibility to inches. I like to see where I'm going and get there fast rather than feeling my way along.

Yes, of course I'll have an HT in my pocket tuned to the local repeater.

Scramble

The Kachina, featured on our August cover, seems to have left the rest of the ham industry in the dust, scrambling to catch up. I think we've now seen a good preview of what our top 21st century ham rigs will look like. Well, it only makes sense to marry our rigs and computers. After all, our rigs have been increasingly computerized with frequency synthesizers and digital signal processing, so the move to a knobless rig that's 100% computer-controlled is an obvious next step.

I'll bet the engineers in To-

JY1

I was discouraged to read that His Majesty JY1 was back at the Mayo Clinic in Minnesota and still "fighting" cancer. The normal treatments for cancer are legalized torture, with chemotherapy, radiation and surgery. I wish there was some way to (a) get word to him and (b) convince him that he doesn't have to be tortured and then die. Even at this stage, which obviously is very far along, if he'd read the book by Dr. Bruno Comby *(Maximize Immunity)*, which I've been recommending for several years as a book "you're crazy if you don't read," I'm convinced he could be totally well now, complete with a full head of hair instead of totally bald.

We get cancer for one reason only: We've compromised our immune system. Our bodies generate tiny cancers continually, but our immune system cleans them up for us. Then, when we weaken our immune system enough, it isn't long before a cancer somewhere is going to win and then we're in deep doodoo. That's when we hear the two words from our doctor that we never want to hear: "Uh-oh."

The National Cancer Institute and the American Cancer Society have been doing everything they can, with the help of the AMA and FDA, to make sure that alternatives to chemotherapy, surgery and radiation are stopped from being developed or known. Hey, if we stop making ourselves sick we could stop spending a trillion and a half dollars a year — that's one and a half thousand billion dollars a year we're costing ourselves. Of course, that would put thousands of hospitals and tens of thousands of doctors out of work, and virtually wipe out the pharmaceutical and insurance industries.

Gee, tough.

So don't upset things by changing your habits and take your chemo torture like a man. Chemo and radiation both wipe out your immune system, so your first and last lines of defense against cancer are gone. Yes, the last stages of cancer can be extremely painful, but the doctors won't give you the painkillers you need for fear of losing their licenses. The needed narcotics can be addictive, you know, so the medical review boards are always on the lookout for any doctors who are prescribing narcotics, and never mind if there are good reasons.

In 1996 the Federation of State Medical Boards met in Chicago and agreed to coordinate a national network to punish any doctors who used alternative methods. For instance, there was Dr. Glen Warner, who had been using the required cancer therapies for more than 20 years at one of Seattle's largest hospitals. He left and started his own cancer institute and, using alternative therapies, had one of the best records for success of any doctor in the country. They revoked his license.

Dr. Warner said, "We have a multi-billion dollar industry that is killing people, right and left, just for financial gain ... doctors, oncologists, they don't want chemotherapy to be disproved. That is where their money is."

From John Robbin's book *Reclaiming Our Health:* "... the vast majority of studies show that radiation cannot cure cancer, and that it can rarely extend life for people with the disease ... the truth is that, for more than 90% of people with cancer, chemotherapy had next to nothing to offer ... oncologists say that they would not allow chemotherapy to be given to themselves or their families ... oncologists characteristically downplay the level of suffering involved with chemotherapy.

The chief chemotherapist at the Mayo Clinic admitted in a published paper that he gave chemotherapy to cancer patients which he knew would not help them, right up to their deaths, in order to keep them from trying alternative therapies.

No, it is not easy to change a lifetime of eating habits, but as you eat you should be aware of what's ahead. And not even the wealth and power of a king will be able to save you from what you've done to yourself.

Hear Wayne Talk!

On my way to a short Aspen ski vacation I'll be stopping off in Denver to give a talk. I hope you can make it. It'll be at the Airport Embassy Suites, January 5th at 7 pm. Yes, it's free. So what'll I be talking about? The same things I write about in my editorials — amateur radio, your health, how to make money, and so on. Or, for that matter, anything you ask about. This'll give me an opportunity to meet you personally, and maybe answer some questions for you.

kyo and Osaka are working overtime to catch up with this American-made evolutionary product.

If you're fortunate enough to get a Kachina, let's hear how it's doing for you. With the sunspots perking away, opening our DX bands for more and more hours a day, let me know what goodies you've dug out of the pileups. Oh yes, if you luck into a truly interesting contact, please make a note of it and let me know the details. I keep fantasizing that such a thing is possible, but I need some sort of evidence to prove this isn't just another W2NSD/1 fantasy.

Skills

Talk about fuzzy thinking! The FCC believes we should have several license classes to "to encourage amateur operators to advance their skills." Skills have never been developed by memorizing a Q&A manual — they're built by doing, so the whole idea that different classes of licenses will build skills is really dumb. It's a crock.

If you want to build your packet skills you get involved with packet. Ditto satellite communications, fox hunting, and all of the other fun facets of our hobby. Unless you're too damned lazy.

Which is why I think that having more than one license class is a holdover from the pre-war ham days when a Class A license permitted you to operate in the two narrow phone bands on 75 and 20m. In those AM days there was room for about nine round tables and that was that, so it was necessary to make it more difficult to get the privilege. Well, that was 1940 and now we're going on 2000, and it's about time our regulations were tailored to meet today's world instead of one a few old-timers like me remember.

It's nice that the ARRL grudgingly has proposed that we cut back to only four license classes. Only? Lordy!

I'd like to see this whole class business junked. Then I'd like to see a lot more articles telling our somnolent brethren how much fun you're having on 6m, with slow scan, and so on. Fan the flames of interest. Tell 'em what fun you're having on our ham satellites. Show us some of the stuff you're doing on slow scan.

How about getting your club to start putting together some videos showing what can be done with moonbounce, with fox hunting, and so on. I'll be glad to help make copies for other clubs to show at their club meetings. We desperately need to get some life into club meetings. So how about producing some 20-minute or half-hour ham videos which will help get a few hams off dead center?

What's happening down on 160m these days? Do a video. Next summer, how about a video of your club's Field Day effort? Don't tell me your members don't have video cameras — so get busy. You could do some great videos of fox hunts. How about one on getting on RTTY?

Clubs go on DXpeditions every now and then. So when's the last time you saw a video report made available for other clubs to enjoy? A video could include both video and slides.

We build our skills by doing things, so let's get rid of our many classes and get busy encouraging hams to get involved with new modes and bands, which really will help build their skills.

Unlimited Memory

Yes, I know, I've written about memory before, but since (a) there are some new readers and (b) your memory of what I've written is probably approaching zilch, let's walk through all this again.

Firstly, scientists don't know where our memory is stored. Oh, they know if they poke an electrode into the brain about here they can stimulate a specific memory. But that's like sticking a test prod into a telephone switchboard.

If you've read much about the brain you know that we have had people who've survived accidents which destroyed around 90% of their brain with no loss of their memory or other functions. Worse, other people have also lost 90% of their brains, but another 90%, and they're doing just fine, too. We don't seem to have any limit to how much we can learn. Our memory, unlike that of our computers, seems completely unlimited. Not that possible memory limitations are much of a potential problem for most people. They read (but not much) and they forget most of what they've read.

Inputting Data

Reading makes it possible for you to get your information from the most knowledgeable people in the world. It's a direct line. It's also an excellent source of strongly held, but unfounded, opinions, so you have to be picky about what you accept as valid data.

Most of us are taught to read in school. But just barely. A growing percentage of our graduates, even from college, are virtually illiterate. Lordy, I wish you could see some of the letters I get!

Reading is a skill and as such it can be improved by you forcing yourself to read faster and faster. But you have to push. It's the same as with running or swimming. You get better at skills by pushing yourself and then pushing harder. The really great thing about reading faster is that the faster you read, the more you retain of what you've read.

Until, with your help, I can get our educational establishment to start producing outstanding educational videos that will teach all of the K–12 subjects in a fraction of the usual time, and make the material available anywhere the

Continued on page 57

Number 6 on your Feedback card

LETTERS

From the Ham Shack

Richard Thompson, Abilene TX. I'm hoping that the readers of *73 Magazine* can help me with some research that I'm carrying out. I'm working on a book on the development of quartz-crystal-controlled communications during World War II.

As I'm sure many of you know, the Army waited until 1940 to decide to switch to crystal-controlled radios. At the time, they felt that since we weren't in a war, the handful of companies manufacturing quartz crystal units (QCUs) could handle the demand. Well, in another year, we *were* in the war, the demand for QCUs was far beyond what they'd estimated, and there was no way that the current crystal industry could handle the job.

The response by the Army was to form the Quartz Crystal Section, under the Signal Corps, whose job it was to develop mass production techniques for QCUs and then to find the manufacturers to produce them. A small group of civilians (geologists, engineers, and physicists) literally created an industry from scratch. A second problem that developed after the industry came on line was the "aging" problem with crystals: a mysterious increase in the natural oscillating frequency after a short time in the field. The physicists at the Signal Corps Lab in Ft. Monmouth, New Jersey, were called on to find the reason behind this problem and develop a solution, which they did.

For my book, I'm looking for first-person accounts of these events. I'm interested in two major areas: 1. I would like to make contact with anyone who may have worked in the crystal industry at this time and who would know something of what it took for this industry to be created, or a ham who might know something about the state of the art in crystals at the beginning of the war; and 2. Any military veterans (especially Army Air Corps) who might remember the effects on communications of first, the shortage of crystal units at the beginning of the war; and second, the problems caused by the aging problem (one of my sources who worked in the Quartz Crystal Section speaks of an urgent telegram to the Pentagon from Gen. Eaker of the 8th Air Force complaining of a serious problem with communications and strongly urging that a solution be found).

Any B-17 radiomen out there? I would love to hear what you have to say. I can be contacted at the following address:

Dr. Richard J. Thompson, Jr.
McMurry University
McM Station, Box 38
Abilene TX 79697
Phone: (915) 793-3875
E-mail: [rthompson@mcm.edu]

How about it? Let's dust off some memories! — Ed.

John G. Boles KA6LWC. I would like to comment on a recent "QRX" article in the October 1998 issue of *73 Amateur Radio Today*, "What to Do About Your Technician Accent" by Bill Smith N2SZW.

In the second paragraph, he mentions not to use the word "clear" when nobody replies to the announcement one is on frequency. This is a "territorial" issue, because in many areas, it indicates that the operator is leaving the local frequency and is not monitoring the repeater, thus ending his communications or attempted communications. In the second paragraph from the bottom, beginning "Avoid endless ...," he proceeds to state that the use of "clear" is acceptable to end a communication. This appears to be a contradiction because when one leaves the local frequency, there's an end to communications and monitoring.

Another issue: The letters PTT have often been used to indicate *Push To Talk*. If you think about it, it really means *Push Think Talk*. The "think delay" allows transmitters and repeaters time to get into the transmit mode so that the first words are not cut off.

I notice that "QRX" has no E-mail address for responses, nor is there any E-mail address for *73 Magazine*. It would be helpful to note any E-mail addresses available on a separate column/masthead.

Actually, 73's E-mail address is on the "Table of Contents" page and is the same for all Departments: [design73@aol.com]. — Ed.

Ned Stevens K7ELP, Murray UT. I really enjoyed the article "What's the Scoop on the Lazy Loop?", by WA2UGT in the September 1998 issue. Besides being very interesting to me it was timely as I was in the process of deciding what low-band antennas to install at this QTH. It sure proves the more wire you have in the air the better you will do.

This article reminded me of an experience I had some 30 years or so ago. I was on active duty with the US Coast Guard, stationed at Lualualei, Hawaii (northwest section of the island of Oahu, a few miles from Honolulu). I was in charge of a communications station transmitter site. We were having some difficulty in communicating with our ships in the northwest Pacific Ocean. At the time all our transmitting antennas were either conical monopoles or an occasional quarter-wave wire vertical. The conical monopoles were broadbanded, as I recall. They were operated from about 4 MHz to 16 MHz. The site had enough space for a longwire antenna so we built a horizontal V antenna, with the vertex pointing to the location of the ships. We made each leg four wavelengths long at the 16 MHz frequency. We used a small ham CW transmitter tuned to 16 MHz to tune the antenna. As I recall, the transmitter was an AT1. We were fortunate, as the feedpoint of the antenna turned out to be 200 ohms. We then made a quarter-wave balun out of the large coaxial cable we used for transmission line. The coax was 50 ohm but about one inch in diameter. This antenna improved the signal to the ships by a tremendous amount, as the communications went from marginal to Q5 at both ends. Something in my memory tells me that we designed the V antenna for the radiation angle for the distance that we were transmitting.

Rich Mollentine WAØKKC, Shawnee Mission KS. Ham radio is a hobby, but on occasion some take it as an obsession—to the detriment of their family and friends. It's like anything else: It should be balanced with the other things of life. Many an XYL will question why we spend 24 hours straight in a contest talking to strangers in Borneo or Pago Pago but have no time for *them*.

Balance your hobby with your other family obligations. 73

WANTED

Fun, easy-to-build projects for publication in *73*. For more info, write to:

Joyce Sawtelle,
***73 Amateur Radio Today*,**
70 Route 202 North,
Peterborough NH 03458.

QRX . . .

Who's Your Hero?

Each year the ARRL honors four dedicated ham radio instructors, teachers, and recruiters. Clubs or individuals are asked to complete a nomination form for the nominees. More information about the awards can be found at [http://www.arrl.org/ead/award/]. If you do not have Internet access and would like a nomination form, please contact Jean Wolfgang WB3IOS at (860) 594-0219, in the ARRL Educational Activities Department.

Nomination forms must then be sent to your ARRL Section Manager before January 31, 1999. A list of ARRL Section Managers is available at [http://www.arrl.org/field/org/smlist.html] or can be found on page 12 of any *QST*.

Ham Astronomer Honored

James Moran K1AKE, of Concord, Massachusetts, has been elected to the prestigious National Academy of Sciences, one of 60 new members announced last April 28. Moran is a radio astronomer at the Harvard-Smithsonian Center for Astrophysics and a professor at Harvard University. He is best known for his application of the techniques of Very Long Baseline Interferometry to the study of astronomical masers.

From the ARRL, via *Newsline*, Bill Pasternak WA6ITF, editor.

Hams Serve in Times of Natural Disaster

Ham radio was on the scene as flash flooding hit Mexico City on Monday, September 28th. Five people died and thousands were left homeless after mudslides unleashed by weeks of heavy rain buried homes in the Mexican capital and left entire suburbs under water.

The storms and mudslides knocked out utilities and telephone service to the affected parts of the city. According to news reports, ham radio operators stepped in to provide lines of communications for search-and-rescue groups and relief authorities. They also worked at warning the people of the dangers in the area and gave basic recommendations to avoid danger.

Ham radio operators in the Balkans were also on the spot with reports as a tremor rocked Belgrade and central Serbia. The quake, which measured 5.4 on the Richter scale, rocked the area early on Wednesday, September 30th. It caused minor damage in the center of Belgrade, knocking out power and telephone service in parts of the city.

Reports from amateur radio operators said people in the area had run from their homes in their nightclothes, clutching their children. The reports said that rubble from one building did crash into a city street, but nobody was injured. A ham in the town of Valjevo reported slight damage there, as well.

From *VHF Reflector*, published news reports, via *Newsline*, Bill Pasternak WA6ITF, editor.

Yet Another Visit from You Know Who

'Twas the night before Christmas, and all through two meters,
Not a signal was keying up any repeaters.
The antennas reached up from the tower, quite high
To catch the weak signals that bounced from the sky.
The children, Tech-Pluses, took their HTs to bed,
And dreamed of the day they'd be Extras instead.
Mom put on her headphones, I plugged in the key,
And we tuned 40 meters for that rare ZK3,
When the meter was pegged by a signal with power.
It smoked a small diode, and, I swear, shook the tower.
Mom yanked off her phones, and with all she could muster
Logged a spot of the signal on the DX Packet Cluster,
While I ran to the window and peered up at the sky
To see what could generate RF that high.
It was 'way in the distance, but the moon made it gleam—
A flying sleigh, with an eight-element beam,
And a little old driver who looked slightly mean—
So I thought for a moment it might be Wayne Green!
But no, it was Santa, the Santa of hams,
On a mission, this Christmas, to clean up the bands.
He circled the tower, then stopped in his track,
And he slid down the coax, right into the shack.
While Mom and I hid behind stacks of *CQ*,
This Santa of hamming knew just what to do.
He cleared off the shack desk of paper and parts,
And filled out all my late QSLs for a start.
He ran copper braid, took a steel rod and pounded
It into the earth, till the station was grounded.
He tightened loose fittings, resoldered connections,
Cranked down modulation, installed lightning protection.
He neutralized tubes in my linear amp—
Never worked right before—now it works like a champ!
A new low-pass filter cleaned up the TV;
He corrected the settings in my TNC.
He repaired the computer that would not compute,
And he backed up the hard drive and got it to boot.
Then he reached really deep in the bag that he brought
And he pulled out a big box. "A new rig?" I thought.
"A new Kenwood? An ICOM? A Yaesu, for me?!"
(If he thought I'd been bad it might be QRP!)
Yes! The Ultimate Station! How could I deserve this?
Could it be all those hours that I worked Public Service?
He hooked it all up, and in record time quickly
Worked 100 countries, all down on 160.
I should have been happy—it was my call he sent,
But the cards and the postage will cost two months' rent!
He made final adjustments, and left a card by the key:
"To Gary, from Santa Claus. Seventy-three."
Then he grabbed his HT, looked me straight in the eye,
Punched a code on the pad, and was gone—no good-bye.
I ran back to the station, and the pileup was big,
But a card from St. Nick would be worth my new rig.
Oh, too late—for his final came over the air.
It was copied all over. It was heard everywhere.
The ham's Santa exclaimed what a ham might expect:
"Merry Christmas to all, and to all, good DX!"

From *Squelch Tale*, Dec. 1996, newsletter of the Chicago FM Club, Inc., Timothy M. Garrity WD9DZV, editor.

Sorry, but we don't have a clue who Gary is (assuming Gary is the author of this year's parody), or we'd definitely have given him credit.—Ed.

Probing Auto Electronics

Help your neighbor identify his car's problem and be an electronics hero!

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

Being a ham, you're expected to know everything about electronics regardless of the application. So have you ever had some neighbors drop over and indicate that they needed your help with their car? Chances are, they've indicated that it won't start or runs poorly, or that the battery is dead.

In most cases, the symptoms described seldom fit the actual situation. But because you're a ham, you're looked upon to be "the neighborhood electronics resource." So how do you approach the problem?

Do you agree to take a look? Or do you shine them on and suggest that they go see the local mechanic? Let's assume that you're at least willing to take a look at the problem to help sort out the details, which may lead to a solution if the problem is electrical. And if it's mechanical, you may have to suggest the mechanic after all.

Electrical problems and solutions in older cars were usually easy to sort out, but the computers used in modern cars make the problems more difficult for a ham to diagnose. In fact, the things that one might be able to do are limited to only a few things, but those could have an identifiable solution within your grasp.

Three situations are discussed here that can help solve many aggravating problems that cars experience and are not under computer control. These situations involve the spark plugs and HV wiring, alternator and battery, and current leakage paths that run a battery down unexpectedly. The test equipment for troubleshooting these three situations is typically available on a ham's workbench: oscilloscope; digital voltmeter/ammeter; and #1157 (or #1034) taillight bulb. So there is very little financial investment required, beyond what a ham normally has available.

Most hams have had some exposure to Ohm's law problems as part of their electronics training. The logic and circuitry involved in Ohm's law problems is exactly the same as that required for solving electrical problems in a car's electrical system. Troubleshooting then becomes a matter of developing a plan or procedure to follow in sorting out the various measurements and symptoms.

Spark plugs

Being able to diagnose a problem in an automobile's high voltage ignition system is both interesting and satisfying. Because of the pulse nature of the system, it can be analyzed dynamically. Using an oscilloscope provides a means of looking at the HV pulses for one or all of the cylinders. Observed conditions can be related to inequality of spark, weak spark, shorted spark plug, defective plug wiring, or intermittent plug firing.

In the case of a standard ignition system (points and capacitor), the point's dwell time can also be observed to determine if coil saturation is being achieved. Dwell time is not a factor in electronic ignition systems. The oscilloscope display can be focused for detailed analysis on one or all of the spark plugs to help sort out differences between them.

To make up an engine analyzer using an oscilloscope, it will be necessary to make up a couple of interface boards to be used as scope probes as shown in **Figs. 1** and **2**. Sync for the horizontal of the scope is obtained from the high voltage using the circuit shown in **Fig. 1**. A wire cuff or broadfaced spring clip is used to provide a capacitive coupling to the HV wire, as a direct connection is not desirable. The circuit integrates the HV pulse to create a single con-

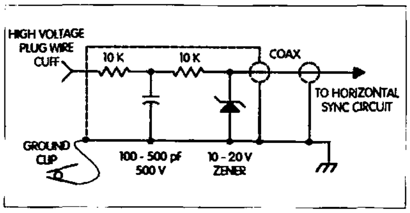


Fig. 1. Sync input circuit.

stant amplitude (a zener diode is used as an amplitude limiter) trigger pulse suitable for synching the scope.

The HV pulse train to be analyzed is obtained from the primary side of the ignition coil using the circuit shown in **Fig. 2** and is applied to the vertical input of the scope. All HV sensing is done in the primary of the coil, not in the actual HV circuit. All of the system's performance is viewable in the primary more so than in the secondary, or HV side, of the coil. A small amount of integration is performed by the interface board, but only enough to make the pulse visible on the screen.

The amplitude pot is used to bring the vertical signal amplitude within the control range of the scope's input attenuator. The pot remains fixed after the initial adjustment. In modern engines, there is a separate ignition coil for each pair of cylinders. Therefore, it will be necessary to move the vertical scope probe from one coil to another to view the next pair of cylinders.

Construction of the probes indicated in **Figs. 1** and **2** is not critical. Some shielding is recommended to keep stray signals from entering the scope, but even unshielded boards have been used successfully. The minimum construction should entail placing each circuit within a plastic box to prevent the circuit from shorting to an engine component.

Test preparation includes connecting the interface circuits to and starting the engine, and running the engine at idle. In operation, the scope sweep is adjusted to approximately 20 ms/cm when displaying all of the plugs at once. Attaching the HV pickup (sync) to plug #1 will allow all of the plugs to be viewed in the order in which they fire (only when one coil is used for all of the cylinders).

Adjust the sweep timing to display four, six, or eight pulse sequences as

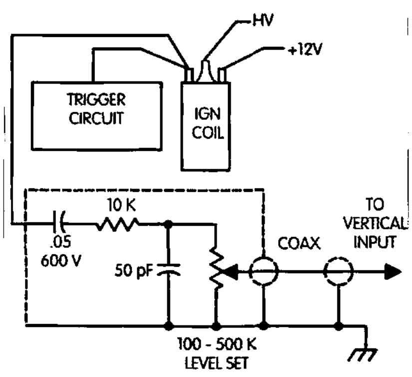


Fig. 2. Pulse input circuit to vertical amplifier.

determined by the number of cylinders present (only two cylinders at a time can be viewed when an ignition coil is provided for each pair of cylinders). To view a single plug, attach the HV pickup to the plug to be viewed and adjust the sweep to approximately 1 ms/cm or until one pulse sequence is observed. Move the HV pickup from one plug wire to another to make pulse comparisons.

Typical waveforms suitable for comparison are shown in **Fig. 3.** Because the waveforms obtained vary somewhat from one engine to another, it is necessary to identify a "norm" waveform for the engine being analyzed. A norm can be determined by looking first at all plugs firing (typical sweep of 20 ms/cm) and observing the similarity as a norm. Then note any differences in the plug patterns observed for a potential problem. Obtain a closer analysis of individual plugs using a sweep of about 1 ms/cm to provide clues as to the health of the ignition system.

To aid in the analysis, look for the series of HV pulses that occurs during a plug firing, then look for the short delay before the next firing. The right-hand end of the delay indicates the beginning of the firing cycle and the left-hand end of the next delay indicates the completion of the firing cycle.

The pulse waveform between the delay periods provides the clues for comparison to the examples shown. A shorted plug wire can be simulated by holding a screwdriver between the engine block and the top of a spark plug while observing the waveform. It is *not* recommended, however, to simulate an open HV wire by removing a plug wire—as electronic ignition systems are subject to damage when an open HV wire occurs.

Alternator and battery

Troubleshooting a battery and/or alternator problem is fairly easy with a digital voltmeter, and the short time that it takes could satisfy your neighbors and make you a hero. The use of a digital voltmeter is preferred, but an analog voltmeter will work with a little less satisfaction in determining specific voltage values. But the general function of "what's happening" can be displayed with an analog voltmeter.

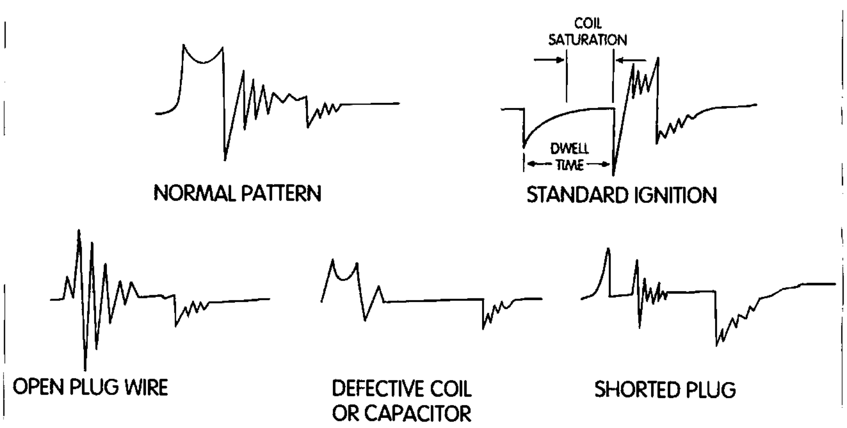


Fig. 3. Typical ignition wave patterns exhibiting specific conditions. Dwell time pattern is specific to a standard ignition system.

Test conditions involve the logic of what happens during static and dynamic conditions where static conditions occur when the engine is turned off. During this period both loaded and unloaded tests can be performed on the battery to determine its present health regarding being charged or discharged.

What you may not know at this time is whether the battery has been charged recently or discharged due to an inadvertent current leakage path. But the first test involves performing a load test which begins by placing the voltmeter across the battery terminals and noting the voltage indication, which should be approximately 13.5 V. While observing the meter, the headlights are turned on. Typically, if the battery is healthy, the voltage indication will remain above 12.6 V and the lights will be fairly bright. The small voltage drop between the load and no-load test indicates the battery to be healthy. If the battery has not been charged recently, perhaps if the alternator has failed, then the voltage differential would be higher—making the battery suspect. But before installing another battery, the alternator will require testing. Because the battery and alternator together make up the power system for the automobile, they must be tested as a system.

Test conditions

I.A. To determine if a battery is capable of starting the engine, you need only to engage the starter. Assume first that the solenoid just clicks, with the starter failing to turn. This indicates one of three conditions:

1. The battery charge is low.
2. The battery is defective.
3. The starter is defective.

B. Two tests are required for an evaluation of the battery, because if the battery is good and the solenoid still just clicks, then the starter is suspect. The starter and solenoid are both suspect if the battery is fully charged and the solenoid fails to click. The first test of the battery involves measuring the terminal voltage under load (headlights *on*) with the engine *off*. Record the voltage readings. Then, after charging the battery, the load/no-load tests are repeated and the voltage values compared.

C. Expected results:

1. If the battery will retain a charge, the terminal voltage will be above 12.6 V for both load and no-load tests.

2. If the battery terminal voltage is below 12.6 V after being charged, then the battery is suspect, as it may be defective.

II.A. Determining the status of an alternator is much easier and considerably faster than testing a battery. Alternator testing is always done with the engine running. With one exception, the engine should not be running when checking for alternator diode leakage.

1. To perform a diode leakage test on an alternator, the following procedure is used. With engine off, the battery cable is removed from the alternator and a voltmeter is placed between the terminal and the cable. Because of the high reverse resistance of the diodes, a voltage indication of less than 12.8 V should be expected. If the leakage is more than might be expected, a #1157 (or #1034) light bulb with pigtails attached to one filament may be placed between the cable and terminal as an additional test method. The light bulb should not exhibit any filament glow. If the bulb filament does glow, then suspect leaky diodes in the alternator. Another symptom of a bad alternator/regulator (particularly if the filament glows during the light bulb test) will be a dead battery after a few hours of non-use.

2. Dynamic tests on the alternator will also check the regulator, brushes, and diode conduction. The terminal voltage across the battery with the engine running at or above idle should yield a voltage between 13.2 and 14.7 V. The voltage value should remain approximately the same whether or not the headlights are turned *on*.

B. Expected results:

1. If the terminal voltage remains fairly constant at a value between 13.2–14.7 V with or without a load, then the alternator and regulator are functioning OK.

2. If the terminal voltage is at 12.8 V or below with or without a load, suspect the alternator/regulator as being defective.

3. If the voltage appears to be regulated but hangs at about 12.7 V, then suspect an open diode in the alternator.

C. **Table 1** provides a guide for making diagnostic decisions regarding an automobile's electrical system. Because of the cost factor of replacing a battery or alternator, replacement decisions should be based upon as many symptoms and available test data results as possible. It is best to perform all of the tests and compare the results of each to identify the bad component.

III.A. One of the most difficult electrical problems to diagnose is a current leakage path that tends to run down the battery during a short period of unuse—24–48 hours, perhaps. Because of the elusiveness of the problem, only a few hints can be provided as to how you would go about solving it. Hams have a solution for almost all electronic problems, even those involving cars. The best suggestion is to consider the car's electrical system as an Ohm's law problem in which there is one voltage source feeding a great number of parallel current paths. It will then be necessary to determine the current flow in each path when each is intended to be *open* circuited.

B. Before starting a troubleshooting process, make sure that all lights including the glove box, trunk, engine compartment, map light, etc., are turned off. It may be necessary to temporarily remove them from their sockets to make sure they are completely turned *off*. It's also a good idea to remove the cigarette lighter from its socket. It must be recognized that the clock and computer will draw some current, but the value should be relatively small in comparison to what a glove box light might draw.

C. The first step in chasing a leakage problem is to determine the magnitude of the leakage path. This can be done by removing the battery cable from the battery. This operation can wipe out the theft code on some electrical devices, such as the radio, within the vehicle, so you must be prepared to re-enter the proper codes following the troubleshooting process. Otherwise, do not remove the battery cable from the battery.

D. Assuming that the above items have been accounted for and found to not be a problem, a DVM and a #1157 (or #1034) light bulb can be used as diagnostic tools for tracing current paths.

1. Remove the battery cable and place the light bulb between the cable and battery terminal. If the bulb filament glows, then take note of the brilliance as a reference for later measurements. Place a DVM set on the amps scale and measure the current value. Anything greater than about 50 mA is considered suspect. The measured value is essentially the current value that must be traced to the suspected branch circuit causing the leakage path. It is assumed here that the alternator and regulator have been found to be OK and checked as in step number II above.

2. Circuits that do not normally go through the fuse block are the headlights, computer, transmission shift indicator, temperature sensors, starter, alternator, etc. If no problem is found in the fuse block test (below), then each of these circuits will require an examination. Each of the circuits listed will have a switch or relay that provides power to the circuit. It will be necessary to examine each.

3. Reconnect the battery cable to the battery and move to the fuse block. Each fuse is to be removed, one at a time, and the current measured in that path. Either the light bulb or ammeter may be used as a current indicator.

E. Expected results:

1. The current in each circuit path should be zero if the circuit is open.

2. The circuit containing the high

Continued on page 23

VOLTAGE	CONDITION
15.2	Overcharging
13.2 – 14.7	Normal Range
13.0	Not Charging
12.7	Possible Open/Defective Diode
11.5	Low Battery

Table 1. Expected battery terminal voltage values based upon typical system conditions.

Announcing the QRPeanut

Here's a compact QRP transmatch you can build for next to nothing.

James P. Fisher N5GZH
P.O. Box 856
Kyle TX 78640

When I was faced with the need for a cheap and compact matching unit for portable, low-power operation, it soon became clear that my options were limited. Available units, I found, were larger than I needed for QRP. And besides, who needs an ATU rated at 200 watts when you're camping or backpacking on batteries at only five? Enter the forgiving beauty of QRP and a simple solution! Low voltages encountered at QRP power levels make ATUs easy to home-brew. And as they say about traveling, "Gettin' there is half the fun." Hence the QRPeanut.

Design and building details

Design of the QRPeanut is a straightforward adaptation of the classic T network as described by Doug DeMaw and others. The chief advantage of this design is its obvious simplicity (see **Fig. 1**). On the down side, it has a "high-pass characteristic," which means that it won't filter out spurious harmonics. However, if your QRP signal is clean to begin with, this shouldn't matter much.

I made L1, L2, and L3 from #22 enamel wire wound on toroids (Amidon T80-2 for L1 and L2, T80-6 for L3), chosen for low loss and compactness. (Toroids are easy. I would rather wind 10 of them than one of those cylindrical things.) The coils are center-tapped and mounted on a "one size fits all" type of circuit board from Radio Shack. After soldering, it's not a bad idea to check connections for DC continuity, since residual amounts of the wire's enamel coating will sometimes produce a bad solder joint.

Size and type of enclosure are mostly up to the builder, but the front panel should be nonmetallic for reasons I will explain later. I built mine in a five-inch by two-and-a-half-inch by two-inch ABS plastic box (Radio Shack 270-1803). *Important tip:* Unless you have the hands of a neurosurgeon and the patience of Job, wiring the rotary switch in place with a box this size will be nearly impossible. If compactness is your goal, consider wiring the toroid board to the rotary switch on a simple "jig" (see **Photo A**). Radio Shack was kind enough to package this line of enclosures with both a plastic lid and one made of aluminum sheet. I made my jig by drilling mounting holes for C1, C2, and the rotary switch and then adding a right angle bend roughly one-half-inch wide for a foot. This allowed me to mount the jig on a small block of wood with screws, forming a stable base on which to work. The completed assembly was then removed from the jig and eased into the enclosure with a little wire bending where appropriate.

The stiffness of the wiring is probably enough to hold the board in place. I used a lump of Coax Seal® as additional insurance. An inductance meter is also handy for checking to be sure

Continued on page 16

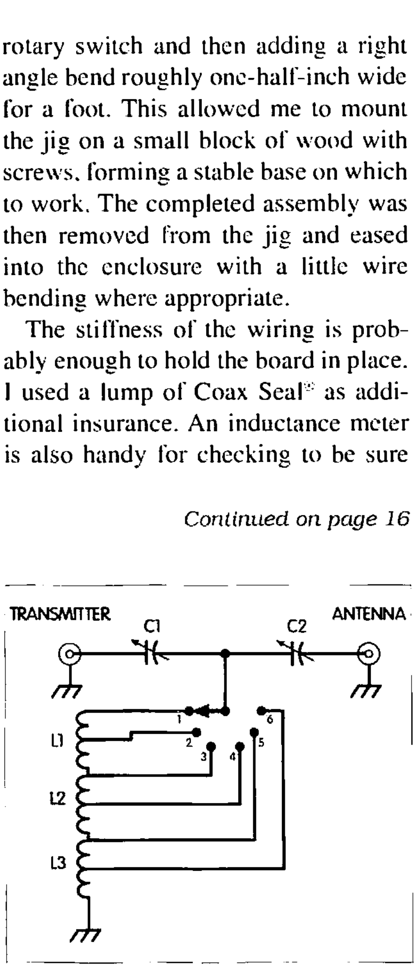


Fig. 1. Schematic.

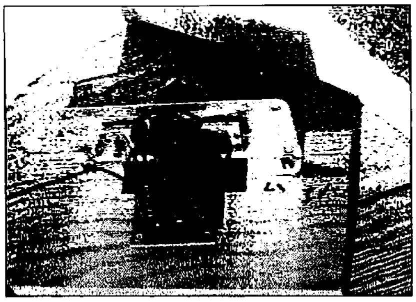


Photo A. The wired ATU on the assembly jig.

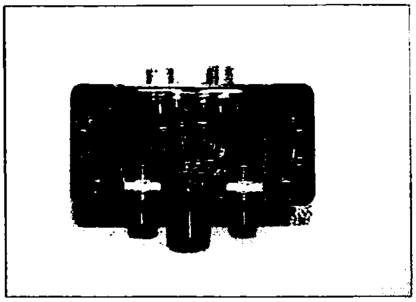


Photo B. Top view.

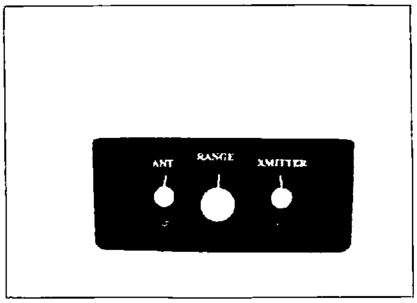


Photo C. Front view.

the rotary switch and toroids are wired correctly.

Since the affordable, air-spaced variable capacitor seems to be going the way of the dinosaur, I chose to use a type of mica compression trimmer having a built-in shaft (ARCO S463). There are tradeoffs. The S463 is a bit quirky; operation is not linear, and the metal shaft is electrically common with one side of the capacitor. *Do not attempt to use these capacitors mounted directly to a conductive panel.* They seem to work fine mounted on plastic and with plastic knobs. Since the single mounting screw is also "hot," use nylon hardware or simply tape over it. (Did I mention the beauty of QRP?) All in all, a small price to pay for components that are compact and cheap.

Choose your favorite flavor of coaxial connector, but since the chassis is plastic, it's a good idea to strap the ground sides together with a bus. I used SO-239s for universality. You may want to build even smaller.

A couple of last tips about those cheap but quirky capacitors. For reasons unknown, shaft diameters are a hair larger than one-quarter inch, so it may be necessary to drill the knob collars to a slightly larger size; 17/64-inch is about right. Hold them for drilling by making a hole in a piece of wood in which the knob will fit snugly. Also, giving the adjustment screws at the back of the capacitors a squirt of contact lubricant (I used Caig DeOxit®) makes operation smoother and should improve service life.

Remember when operating that most of the range of the capacitors is in the last two clockwise turns. Other than that, the QRPeanut works like any other transmatch.

Parts List

C1, C2	ARCO S463*
L1	28 turns #22 enameled wire on Amidon T80-2 core, center-tapped
L2	24 turns #22 enameled wire on Amidon T80-2 core, center-tapped
L3	18 turns #22 enameled wire on Amidon T80-6 core, center-tapped
Rotary switch	2-pole, 6-position, RS #275-1386, cut shaft to 5/8"
Toroidal cores	2 ea. Amidon T80-2 (red) 1 ea. Amidon T80-6 (yellow)
Circuit board	RS #276-159
Enclosure	plastic, 2"x2-1/2"x5"

* Source:
Surplus Sales of Nebraska
1502 Jones Street
Omaha NE 68102

Table 1. Parts list.

Keys to Better Operating

Yes, much of it is common sense ...

Bob Shrader W6BNB
1911 Barnett Valley Road
Sebastopol CA 95472
[w6bnb@aol.com]

There is a proper way of operating radio transmitters on the air to produce the most efficient and interesting communications. The basic rules are reasonably simple. They are things with which you will probably agree if they are considered a bit. The undesirable operating items discussed here have all been heard recently on the ham bands. Let's not be the ones who operate that way.

It might be said that the cardinal requirement in any communicating, whether by telephone, by computer, by RTTY, by SSB/AM/FM radiotelephone, or by radiotelegraphic CW, is to make sure that all of the information transmitted is received by the receiving operator. Actually it is up to both the receiving operator and the transmitting operator to do everything possible to ensure that this cardinal requirement is met.

The emphasis here will be on phone and CW operating. One of the things that can interfere most with receiving all of the information sent is speed. If transmission speed is faster than can be received correctly, regardless of the means used to do the communicating, all of the desired information will not get through.

Radiotelephone operating

The basic theory behind calling another station is to attract the attention of the station to be contacted (usually by calling CQ) and then advise who is doing the calling. Using voice communications, if two stations know each other well, the desired station's callsign can be transmitted, followed by "This is," then the callsign of the calling station, probably transmitted only once.

When stations are not known to each other too well, if at all, the called station's callsign can be sent once (maybe twice), then "This is," and then the calling station's callsign, first with regular spoken letters and then repeated phonetically. If conditions are not good, callsigns may have to be repeated more than this.

There have been many different "phonetic alphabets" used in amateur radio. Some used names, some used cities, some used states or countries, and some were just supposed to be witty. Today the generally accepted international phonetic alphabet is:

Alfa	November
Bravo	Oscar
Charlie	Papa
Delta	Quebec
Echo	Romeo
Foxtrot	Sierra
Golf	Tango
Hotel	Uniform
India	Victor
Juliett	Whiskey
Kilo	X-ray
Lima	Yankee
Mike	Zulu

Table 1. Internationally recognized "phonetic" alphabet.

A suggested pronunciation of the 10 numbers to make them more distinguishable when spoken might be:

1	Wun-uh
2	Too-uh
3	Thu-ree
4	Fo-wer
5	Fy-yiv
6	Sicks
7	Seven
8	Ate
9	Ny-yun or Nine-er
0	Zee-row (not "Oh")

Table 2. *Pronounce the numerals so there can be little possibility of confusion.*

As an example of the use of phonetics, suppose you want to call an amateur station with a call such as "VE3BCG." Since this call is made up of all "eee" sounding letters and numbers, unless very carefully enunciated, some of the letters could easily be misunderstood. If spoken as "Victor Echo Thu-ree Bravo Charlie Golf," there is little chance of receiving the letters incorrectly.

Clarity

Clarity is one of the things which can interfere with the cardinal requirement of phone-type operation. Received signals may not be understandable if the transmitting operator is not using the microphone properly, if the modulation circuits are not functioning properly, if the microphone gain control is not set properly, if words are mispronounced, or if the person doing the talking does not enunciate clearly.

Microphones can be misused. There is always a certain amount of noise generated in audio circuits, but the microphone signal should be about 30 dB above that. If this value of signal is used, your contact is likely to be successful. This value can be found by on-the-air tests to determine how close the mouth should be to the microphone, and the point where the audio gain control should be set. Since most amateur radio station rooms are not soundproofed, if the mouth-to-mike distance is more than perhaps four or five inches, the mike gain may have to be raised to where room echoes begin to be picked up and transmitted. I have a wire guard on my microphone that extends out two inches. If the guard wire is held to the upper lip the modulation will be kept reasonably constant.

It would be nice to be able to set the mike on the desk, lean back two or three feet from it and talk (in soundproofed rooms at broadcast stations, this is possible and is what they often do).

If amateurs speak too far from the microphone, room noise and echoes will usually become annoying to listeners and can interfere with understanding. With too high a gain setting, if a telephone rings, or another receiver in the room sounds off, or people are talking nearby, or dogs are barking outside, all of these will create interfering output sounds from the transmitter. If the speaker is too close to a microphone, aspirant letters such as B, P, S, T and X may produce a puff of air or a hissing that hits the diaphragm and causes a distorted output signal. Rubber foam, cemented over the microphone front, may reduce this effect. If the operator speaks *across* the microphone from a distance of about an inch, rather than directly into it, the unwanted aspirant effect will be lessened. A person who speaks in a loud voice can be farther away from the microphone than someone who has a more subdued voice. All of these items must be considered when setting the microphone gain control. The best way to determine gain settings is to check with some other ham on the air.

Pronunciation, the proper sounding of letters and syllables in words, is important. Foreign amateurs, not skilled in speaking your language, are often unable to pronounce even some fairly common words. When speaking to these people, slow your speech materially, clearly enunciate all words and pronounce them carefully and properly. Think of yourself as helping to teach foreign hams the proper use of your language.

Enunciation is improved by using the lips, tongue and jaw to allow all of the syllables of all words to be produced properly. This is very important when speaking into a microphone. When you speak face to face with someone, their lip movements are seen as their voice is heard. When a microphone alone is being used, the assistance of reading the lips and facial expressions is gone. It is therefore more difficult to understand what is being said. Insufficient movements of the lips can result in mumbling, which interferes with comprehension. Keep those lips moving!

Calling and answering

When calling CQ on phone, listen first on what is apparently a clear frequency for a while. Make sure your transmitter is on the same frequency to which your receiver is tuned by turning off the RIT control on newer equipment. If the frequency appears not to be in use, and if tuning is necessary, tune up on the frequency as rapidly as possible and ask, "Is this frequency in use?" If there is no answer, after a few seconds, call "CQ" a couple of times, sign once a little slower than normal, using plain letters, then repeat the callsign phonetically, ending with, "Over," or perhaps, "Standing by." If no one answers it probably means no one happened to be tuned to and listening on that frequency. A single short "CQ" only produces results if someone happened to have his receiver tuned to that frequency. The chances are poor that someone will happen to tune across your frequency, let alone zero in on it precisely during the few seconds that a short CQ takes. Look at it as if you were fishing. You would not throw a line out and then in 10 seconds pull it back in again and quit fishing for the day. After about 15 seconds try another CQ to try to catch someone tuning around. This time call "CQ" four or five times and sign once. Repeat this two or three times so anyone tuning across your frequency will have time

to zero in on your frequency. After the last CQ, sign once using plain letters and then phonetically, followed by an "Over." It is not good to string a long, long series of CQs together that take up a minute or more. Use 20- to 30-second CQs. If no one answers, try again after 10 or 15 seconds. Unless you are after DX contacts, don't answer the CQ of a station you cannot hear well, particularly if you are using low power.

Remember, when using SSB there is essentially no carrier being transmitted that a receiving operator can hear. Many times a transmitting operator hesitates at the end of a sentence and the other operator starts talking, thinking it has been turned over. Unfortunately at the same instant the first operator may resume speaking. The resulting "doubling" results in neither operator's hearing the other. Always try to use an "Over," or the other operator's name with a rising inflection, or your callsign at the end of transmissions, to indicate you want the other operator to start talking. When listening, wait for some kind of indication that the other operator is expecting an answer.

To check into an SSB net, if transmitter carrier and antenna tuneup is necessary, either zero-beat the frequency of the station transmitting to do your tuning, or move to a clear frequency three or more kilohertz away. In the latter case, when tuned, shift to the net frequency and wait for the transmitting station to turn it over to the next station. If the net is operating properly, the next station should not start transmitting for a second or so, to give any station wanting to break in a chance to do so. A break-in station should say, "Break," or perhaps "Here is XXXXX" (your callsign). The net control should step in, recognize the new station, and advise the proper action to be taken. Always allow the net-control station to handle break-in stations. If two or more stations try to handle a break-in station there will be confusion on the frequency.

Any time a transmitter emits a signal on the air the FCC requires it to be identified by callsign. At the end of a tuning session always transmit your callsign. Station identification is also required every 10 minutes during QSOs. It is not necessary to continually identify if making short back and forth transmissions which require only a few seconds to a minute or so. Keep track of ID times with all QSOs. A wind-up timer works nicely for this. Whenever you transmit your station callsign set the timer to 10 minutes. When it rings it is an indication that it is time to send your callsign again as soon as it is possible. It is wise to ID at the beginning of any transmission. If one of your transmissions lasts more than 10 minutes, at the bell, stop at the end of a sentence, sign your call and then continue with the transmission. Most phone QSO transmissions do not take 10 minutes, but each time you sign over to another station your callsign should be given and the timer set. Station ID is always required when a station makes a final sign-off. There

Continued on page 20

Keys to Better Operating
continued from page 19

is apparently no requirement that the other station's callsign must be sent, but it seems only proper courtesy to send it at least when signing off.

CW operating

The term "CW" means "Continuous Wave," a different kind of a wave than the original spark-type emissions used in the early days of amateur radio code transmissions. Spark transmitters produced waves that varied up and down at some audio rate. It was the variations that the old receivers detected. When vacuum tubes were developed and were used in RF oscillators, they produced a constant-amplitude wave output, thus the term CW. When spark transmitters were outlawed on the ham bands in the late 1920s the term CW continued on as meaning Morse code radio transmissions.

Radio code operating has many well established and excellent communicating rules first developed by commercial railroad Morse operators and then seagoing and point-to-point radio operators. Such jobs depended on making perfect copy of all transmissions. Over the years they ironed out all of the undesirable methods of sending CW on the air. It is from their basic rules that our modern CW and even most of the phone transmission recommendations above were developed.

The basic calling procedure with CW is to call a station by sending its callsign, then "DE" (meaning "from"), and then sending the calling station's callsign. If conditions are good and the two stations know each other well, sending the calls only once may be adequate. In many cases in amateur radio, two stations will not know each other well. When answering a CQ, with modern equipment, probably one transmission of the calling station's callsign is sufficient but after the DE the answering station should always send the answering station's call at least twice. Even if the path is good, for a variety of reasons an answering station should repeat his/her callsign two or three times. It is not often that the called station's callsign must be repeated—that station can recognize its own callsign quite easily, even through QRM and QRN. An exception would be when the answering station is not on the frequency of the calling station. In this case it may be necessary to transmit the CQing station's call several times. When an answering station does not answer very close to the calling station's frequency, troubles may develop.

Obviously, if an operator sends too fast to another operator, time is being wasted. Only minimal information will be received. If an operator can only receive at 13 words per minute, it will be useless to send at 20 wpm. On the other hand, a 30-wpm operator can slow to 13 wpm with no trouble. If CW operators try to send faster than they can copy well, there is little chance that the higher-speed transmission will be too readable. (Of course, if a keyboard is used, sending speed will only depend on the *typing* ability of the person at the keyboard.) Try to determine the other operator's highest correct receiving speed as soon as possible. Whenever questions are asked but are not answered, the sending speed is probably too fast, assuming the sending is faultless. If break-in keying is being used and there are too many breaks being made, slow the sending. It may not be poor sending at the sending end, nor poor copying at the receiving end; it may be QRN crashes or QRM signals which may be unheard at the sending end that are interfering with the copy. Do not hesitate to use "QRS" (send slower) when conditions are poor. When QRN is bad, always reduce sending speed. The longer dots and dashes of slower sending extend the time of each letter, causing only part of a letter to be broken rather than possibly two or more letters by a static crash. One broken letter can usually be guessed, but two or more may cause confusion at the receiving end.

If sending CW with a keyboard, determine what speed a receiving operator who is not using a machine can copy adequately. Do not exceed that speed. If an operator is hand-sending at 20 wpm and it is being displayed on a monitor fairly well, send no faster than that when answering. If answered on a keyboard at 25 wpm, the sending operator will probably try to speed up, may make a mess of it, and the cardinal communications requirement is defeated.

When an operator is sending by hand to a computer keyboard monitoring station, the operator must send only up to the speed at which letters and spacing are error-free. Machines can only copy Morse code letters which are made within certain time limits. The dots must be close to one-third the length of the dashes, and the space times between dot and dashes must be equal to the length of a dot. Spaces between words must be more than those between letters. Letters must not be split. *Diditdahdit* is F, but *didit dahdit* is IN. It may sound almost the same to the ear, but the machine is not fooled! When there is QRN at one or both ends, slow down, even when using a machine.

Splitting letters or running two letters or words together when sending Morse code is easy to do, but can be very confusing to the receiving operator. If GT, MA, TK, or Q is sent, but the word MET is what was supposed to have been sent, the receiving operator can get confused. When an L is supposed to be transmitted but it comes out "*didahdit dit*," that is RE, which results in a misspelled word and possible confusion. Make sure there is spacing in between *all* letters, but *no* added spacing in between the dots and dashes of letters. Furthermore, there should be more space between two sentences than between two words. If "deter mine" is sent, does it mean that, or was it supposed to mean "determine?"

While it is quite proper to use keyboard-type punctuation marks on the air, such as a period at the end of sentences and commas, amateur operations have come down through the decades with the general character "BT" used to mean the end of a sentence, or end of a paragraph, or just a means of stalling while thinking about what is going to be transmitted next. It is not required to send a "KA" at the

start of operations, nor is anything other than a K needed to turn over to another station in most cases. In DX operations the use of KN is OK as it indicates "I am not finished talking to this station; please do not break in." Never use KN after a CQ!

A hard and fast CW sending rule is: "If an error is made while sending a word, stop, send an error sign, go back to the *beginning of the word*, then resend the *whole* word." Never stop and send only the mis-sent letter correctly. Worse yet, do not add a missing dot which was supposed to have been the last part of the previous letter! Send only whole letters, never broken letters. Send only whole words, never broken words. The correcting rule can be expanded to:

•When an error is made in sending the *first letter* of a word, stop, send an error sign, go back and resend the whole word *before* the improperly sent letter and continue on.

This is absolutely necessary when handling traffic messages.

How is an error sign made? Internationally it is eight dots, although "?" or "??" may be used, and sometimes "SN" is used. Whatever error sign is used, it really only has to be something that cannot be copied as a letter, number, or a misplaced punctuation mark. It has to be something that stops the receiving operator's copying.

As with phone communications, after 10 minutes of operating, a station is required to send its callsign. End all five- to 10-minute transmissions with your callsign and a K. If a short answer is required, after sending the question, end with the question mark and a K. With such short transmissions do not bother with callsigns. Wait for the 10-minute period to come up. Operators often use "BK," apparently meaning, "Back to you." The letters "BTU" mean the same thing.

It is standard procedure in DX pileups to call the DX station with just the callsign of the calling station once or twice, close to the DX station's frequency, or on any frequency to which it indicates it is listening. The loudest station being heard by the DX station will be the first worked, of course. But keep trying every time the station signs clear. However, do not use this procedure when answering non-DX CQs—it may sound to the CQing station like some station is ending a test, or some station is being improperly called. A CQing station wants to know that whoever is answering is actually calling the CQing station. In many cases the CQing station may not be tuned to the answering station's frequency for some reason and may not hear the first part of the answering call.

The Q signals

When calling CQ on CW the procedure is very similar to that discussed for phone. With CW you should normally send at the speed at which you want the answering station to use. Don't be afraid to answer a 30-wpm CQ call at 20 wpm. Most of the better operators are quite willing to work at *somewhat* slower speeds, but it is generally not a good idea to answer a 30-wpm CQ with a 5- or 10-wpm reply. If band conditions are bad, due to QSB or QRN, always call and operate at slower than normal speeds.

Using CW, before calling "CQ" on a frequency, use the Q-signal, QRL?, which means, "is this frequency in use?" Do *not* send "QRL" before a CQ because it means, "This frequency is in use, please do not use it." QRL alone indicates someone is replying to a "QRL?" call of a station which the listening station may not be able to hear. If someone sends QRL? on a frequency you and another station are using, answer this question with the statement, "QRL," or possibly, "Yes." Always remember, the station you are copying may be in the skip zone of the station sending the QRL?.

There are over 50 internationally used CW Q-signals. Those that amateurs are most likely to use are shown here in table form.

Continued on page 22

QRG	The frequency is ...
QRK	Your readability is ... (1 – 5) (See QSA also)
QRL	This frequency is in use; please do not interfere
QRM	Interfering stations
QRN	Interference due to static or other noises
QRO	Increasing to ...; or using higher power
QRP	Decreasing to ...; or using low power
QRQ	Send faster
QRS	Send slower
QRT	Stop sending
QRU	I have nothing for you
QRV	I am ready; start sending
QRX	Wait; I will call you shortly
QRZ	You are being called by ...
QSA	Your signal strength is ... (1 – 5)
QSB	Your signals are fading
QSD	Your keying is defective
QSK	I can hear you between my signals (I am using break-in)
QSL	I acknowledge or confirm receiving ...
QSO	I can communicate with you ...
QSP	Relay a message to ...

Table 3. *Handy reference to the most commonly used "Q" codes.*

Keys to Better Operating

continued from page 21

When followed by a question mark, any Q-signal asks a question. For example, QRG? means, "What is my (or your) frequency?" QRZ? means, "By whom am I being called?" While there may be amateurs who discourage the use of Q-signals with radiotelephone communications, some Q-signals fit in very nicely with such operating. As examples, QRM, QRN, QRP, QRX, QSB, QSO, QSL (also a confirmation card for amateurs) and QSO are often heard. On phone, "Use VOX" (Voice Operated Xmissions) means the same as "QSK" does with CW. The use of QSK and VOX helps greatly in QSOs and nets on the amateur bands and should always be used if possible.

Tuning

Tuning a transceiver exactly to another station's frequency with CW is more difficult to do than with SSB. With SSB, if the receiving operator's RIT control is off, when a station is tuned in so the voice sounds most natural, the listener's transmitter should be exactly on the other station's frequency. This is known as "zero-beating" the two transmitter frequencies.

When tuning in a CW station using a transceiver, and again, providing the RIT control is off, the receiving operator's transmitter will be set to something between perhaps 300 and 1000 Hz from the transmitting station's frequency when it is tuned in. With most transceivers, whatever beat-tone frequency is produced by a received signal, if the tone heard when the key is pressed is the same, the transmitter signal will be very close to zero-beat with the received signal. If the key-down and the beat-tone frequencies are different by 500 Hz, then the receiving operator's transmitter will be 500 Hz away from the other station's carrier frequency. If a receiver uses a 250-Hz wide CW IF filter, signals 500 Hz or more away may never be heard. It is very important when answering a general type of CQ to answer as close to the calling station's frequency as possible. In DX pileups if there are many signals on the DX station's frequency, it may pay to detune a few hundred hertz to answer the DX station.

In older-type equipment, where the transmitter and the receiver are separate units, if you want to call "CQ" it is necessary to learn how to tune the transmitter to a desired clear spot in the band. Either turn off the final amplifier stage, or use a dummy load on the transmitter, or turn the transmitter's output power down to minimum before tuning it across the band until the transmitter's signal is heard in the receiver as a tone of about 700 Hz. A CQ can now be called on this frequency after an unanswered QRL? is transmitted. Unless you are after DX contacts, do not answer the CQ of a station whose signals are poor due to band conditions.

Zero-beating

To zero-beat a received signal, such as a CQing station, with a separate transmitter and receiver, tune the

transmitter's oscillator until its tone in the receiver exactly matches that of the tone of the CQing station. Many transmitters have a "Calibrate" or "Test" switch or button which only activates the transmitter's oscillator to allow zero-beating the local transmitter to a received frequency. It provides a weak transmitter oscillator signal for the receiver but produces no radiated signal during the zero-beating process. When using more advanced transceivers, with their RIT control off, when the frequency check switch is on, the tone heard must match that of the beat-signal tone of the received transmitter signal to ensure zero-beat operation.

How close to zero-beat should stations be? If they are on exactly the same frequency that is as good as it can get. In the case of CW stations, they probably should be within 100 Hz of each other or they may be taking up too much of the band. Vacuum-tube transmitters with VFOs almost always drift. They may have to be checked for zero-beat operation every few minutes while the other station is transmitting, particularly if they have not been warmed up for 30 to 60 minutes.

Stations operating several hundred hertz apart are just asking for interference troubles. While one of the stations is transmitting the other station's frequency is not being used. It may be selected as a good spot for a QSO by two other stations, or a good spot for a CQ. If a QRL? on that frequency gets no answer from the transmitting operator, there is no reason why that frequency should not be used for a CQ or QSO. It will then be up to the transmitting operator to advise the other operator with whom he is in QSO to zero-beat with his/her frequency. If the transmitting station was using QSK, the QRL? call would probably have been heard and an answering QRL could have been sent to stop the CW or QSO on that frequency.

It should be mentioned that there are procedures used by the various armed services which may vary from international operating procedures. Those procedures were developed to fit the needs of their particular services. Radio amateurs have always used the procedures which are in general use all over the world, those which have been explained here. Communications will be much more pleasurable if all amateurs use the same basic time-tested procedures.

It is unfortunate that thousands of well-meaning amateur radio Elmers are either ex-military people or are mostly phone operators and do not know the proper international procedures for amateur CW operating. The result is many poorly trained new amateur radio operators on our bands today. Poor operating takes much of the fun out of both phone and CW operating. Hopefully this information will get to some of those Elmers and to those they are helping so much. 73

Probing Auto Electronics

continued from page 13

leakage path should exhibit a current value similar to the value determined as a reference at the battery terminal.

F. Taking note of the circuit and the current measured at each fuse position (circuit branch) will provide a clue as to which circuit contains the excessive leakage path.

There is an alternate test method that may be used when two people are available, one to perform the test and the other to watch the light bulb. If the light bulb filament glows when connected between the battery terminal and cable, then leave the bulb connected and open each fuse circuit and potential circuit path. The light bulb will cease to glow when the leakage path has been opened.

Following the logic of an Ohm's law problem analysis will provide the clues necessary to diagnose automotive electrical systems. Help your neighbor identify his automobile's electrical problem and be a hero! 73

73 Review

A Real Handful

Inside Alinco's DJ-C5 dual-band transceiver.

Terry Bennett VE3EGA
PO Box 293
Markham ON L3P 3J7
Canada
[tebenne@ibm.net]

A credit card-sized two-meter + 70 cm transceiver small enough to *really* go in your shirt pocket was too much for this miniature-radio lover to resist—I had to get me one of those babies! As an Alinco DJ1-FT owner, I was familiar with the company's attention to detail and the general reliability of their products. A quick look at the C5's specifications convinced me that the DJ-C5 had a lot going for it.

I had heard that the new Alinco DJ-C5 radio was going to be available at Dayton, so as soon as the main arena opened I was checking out prices (the Dayton price was just under $200). I had previously checked the DJ-C5 specifications, so my justification was simply this—I needed a radio that was versatile, easy to use straight from the box, and small enough to carry just about everywhere (WHD = 56 mm x 94 mm x 10.6 mm, 2.2 inches x 3.7 inches x 0.417 inch). What's more, the DJ-C5 weighs in at a mere 80 grams (2.82 oz.) and operates off a 3.8 VDC lithium-ion battery.

Out of the box and on the air!

On unpacking the radio (at the Hamvention®) I was delighted to find that it actually did work straight from the box—no battery charging—as the internal lithium-ion battery was alive and well! I quickly set up a simplex frequency in VFO mode and was in QSO within 10 minutes of purchasing the radio—not many handheld manufacturers can guarantee this kind of quick setup! The radio is housed in an aluminum case and all functions are keypad-controlled except for the on/off switch and PTT. The radio comes complete with a charger and clear plastic (I didn't like this!) carrying case. The C5's transmitter is 300 mW—enough for line of sight working, but within buildings (Hara Arena) sometimes hit-and-miss. On nonrepeater channels, QRP usually needs unobstructed RF takeoff! Higher-powered radios also had their share of problems (due to high RF noise and obstructions), so I was not unduly concerned.

The radio's audio output level (60 mW) was, unfortunately, not high enough to overcome the extremely high ambient noise level at Dayton, and even an *additional* purchase of the tiny EME-49 speaker/mike did little to improve matters. I initially solved the problem by initiating the Bell feature on the radio, which gave me a pleasant alert tone when someone called on the frequency! However, I did make a mental note of a neat solution for future flea markets, so watch out for a future article!

First repeater contact

Later that day and back at my hotel, I was able to find the local (Piqua) repeater and exchanged reports with a couple of hams who gave the radio an excellent audio report. My Dayton friends challenged my wisdom in purchasing a 300 mW radio instead of a typical higher powered unit. (I was ready for this one!) I explained that with two meters and 70 cm on board, I will always be in range of at least one repeater practically everywhere I might visit in the USA or Canada. With 50 memories to play with, life will never be dull!

The skeptics were still unconvinced, hugging their brick-sized radios, their speaker-microphones hanging from their collars like sleeping bats, as they mumbled things about needing lots of power. In the meantime, I simply popped the C5 in my shirt pocket and off I went to load more repeaters into the radio's memory. Right now (days after Dayton), I am at the office, C5 in my shirt pocket and ready for more lunchtime QSOs—I'll take a bet that

their radios sit at home in their shacks until the next hamfest.

Planning

A word of caution! Loading 50 memories needs some careful planning—I suggest thinking carefully about future trips and your general ham radio activities. Enter frequencies according to your own personal requirements! Adding and deleting frequencies is, however, very simple with the C5, and a few minutes with the manual will get you started.

I set up my C5 so that the first 10 memories would be two-meter local repeaters, the next 10 would be the major two-meter metropolitan area (in my case, Toronto) repeaters, and the next 10 would be out-of-town ones. UHF repeaters were programmed from #30–45, leaving room for five simplex or "scratchpad" channels as required! The two-meter calling channel of 146.520 MHz was programmed into the VHF call memory. I didn't bother programming a UHF call frequency due to low activity on UHF simplex in my area.

Operating and programming the C5

I have noticed that most small radios have comprehensive manuals that require you to sit quietly for an hour or two in deep concentration studying the intricacies of the radio. Not the case with the C5. The folks at Alinco managed to condense theirs into an easy-to-understand *(and remember!)* 20 pages—which can *also* fit in a shirt pocket if necessary!

Programming the radio was a piece of cake. Simply select the desired memory channel number (using up/down buttons); return to VFO mode (VM/MW button); use the up/down buttons to select the desired frequency; press function (F); and hit the VM/MW button to store! This procedure is all that is required to change a stored frequency. The range of repeater offsets can be set between zero and 99.995 MHz. Once the offset is programmed, pressing Monitor allows you to monitor the repeater-input frequency. Pressing Monitor again returns the radio to normal operation.

A neat feature of the C5 is the inclusion of the aircraft band and of Automatic AM Receive—great for checking out the action at local air shows!

The DJ-C5 has CTCSS built in for both TX and RX (as required); selecting from 26 standard tones will give you all the regular tones in use. The C5 will automatically activate the encoder with the same decode tone when set!

The C5 features Automatic Power Off, Key Lock, Adjustable Frequency Step, Channel Scan, Battery Saver, Bell and (for those of you who are overseas travelers) European Tone Burst. As a general rule of thumb, I find that the C5 will access local VHF/UHF repeaters that are within an eight- to 10-mile radius of my QTH and that the communications capability is somewhat more efficient at UHF as the antenna is much closer to one-quarter-wave-length long. Walking around my town, I found that the audio level (range is 1–8) was most comfortable at level 7, even with vehicular QRN. I find that I am now taking a radio to places where I would previously wouldn't have. If you are part of an ARES group or local Emergency Service, this flexibility may help you to avoid missing a callout message. I am even considering putting a DJ-C5 on my Yorkshire

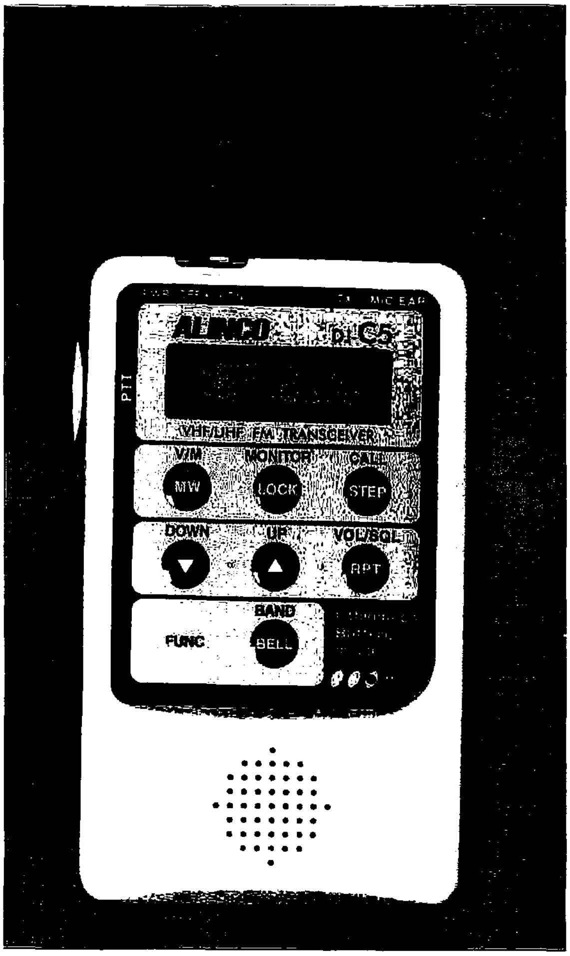


Photo A. *Alinco's DJ-C5, actual size.*

terrier to avoid shouting! The possibilities are endless with such a tiny, lightweight radio.

Battery charging

The DJ-C5 charger operates by dropping the radio on its back into the charger (a really neat unit that holds the radio in place). A green LED indicates charging and extinguishes after charging is complete. Maximum charge time is two hours. A great thing about lithium-ion batteries is they do not develop a memory (unlike nickel-cadmium) and therefore will offer much longer periods of operation per charge! The manual suggests that they are good for 500 charges, so I strongly recommend charging habits different from those used for nickel-cadmium batteries. For example, *If the radio works, the battery don't need charging!* The reason? It has a straight-curve discharge (think of your car's gas tank!). Using this thinking, you will be sure to get the maximum benefit from your lithium-ion battery technology!

Removing the screws on the rear of the radio accesses the C5's battery (if this is ever required!). Gently lift off the back cover and set it aside. I recommend purchasing a new set of tiny Phillips screwdrivers (Radio Shack®) prior to attempting this, as the screws are tightly fitted and there is always the danger of damage to the screw head! The battery takes up about one third of the total size of the radio. To remove the battery, simply ease it out and unplug its connector. Replacement batteries are available (at this time) from Alinco, priced at approximately $35.

Specifications

The DJ-C5 (out of the box) covers 118–173.995 MHz Rx (118–135.995 AM Rx) and 420–449.995 MHz. Tx coverage is 144–147.995 and 420–449.995 in two bands.

A MARS/CAP modification is available (simple) that will extend the Tx from 136–173.995 MHz and 380–472.995 MHz (aircraft band is unaffected).

The radio's sensitivity is excellent, even with the supplied 4.5-inch flexible antenna. I receive the weather radio stations quite well (good sensitivity test for Rx and antennas!).

I have not tried an alternative antenna on the radio, as I felt this would compromise the threaded connector, but the radio may accept a modified antenna for balloonist or similar operation.

As I previously mentioned, the Rx audio (60 mW) is not as high as with "brick" HTs, but it is more than sufficient for normal personal outdoor use in parks or streets. An audio accessory is recommended for flea markets or areas where the ambient noise is likely to be high. This is a miniature (2.5 mm) stereo-type jack socket on the top of the radio that accepts remote mike/audio accessories.

To date there is a good range of Alinco accessories that can be used with the DJ-C5. I purchased the miniature speaker/mike (model EMS 49) and I will ultimately add an ear mike (and dark glasses!).

A word of advice: Subminiature stereo jacks are hard to find. Those of you who want to add your own mike/audio I/O (e.g., packet) won't find them at Radio Shack—you'll need to check out Mouser or a similar supplier.

Conclusion

I love radios that are easy to understand, program, and operate. And I hate hunting for the manual and relevant sections every time I want to change something. For these reasons alone, the C5 is the perfect partner for the user who wants a less complicated radio, yet still needs to retain commonly-used features such as input-frequency monitoring, channel scan, and quick frequency entry. Plus, the DJ-C5 has dual-band versatility, too!

Will I sell mine at the next flea market and get something with more power? No and no. I'll keep this rig, thank you—well done, Alinco!

Sources

The Alinco DJ-C5 dual-band transceiver is available from:

Alinco USA
438 Amapola Ave. Suite 130
Torrance CA 90501
Tel: (310) 618-8616

Further information is also available from Alinco at [www.alinco.com]. And you might be interested in my own Web page [www.angelfire.com/biz/cqradio], where there is also an Alinco link (a linko?). Have fun!

Electronic Bug Emulator

Put some personality back into your CW.

J. Frank Brumbaugh W4LJD
P.O. Box 30—c/o Defendini
Salinas PR 00751-0030

How many of us initially succumbed to the lure of an electronic keyer and sold our bugs, only to become dissatisfied at the lack of personality in our CW? Or made keying errors with the new gadgets and wished we had our old bugs back? Yes, you and me and lots of others. With this article. I hope to take many of us forward to the past.

New standard Vibroplex® bugs cost $160. and the price rises rapidly for the fancier models. This is a cost most of us cannot afford to pay. But all is not lost. Described here is a very simple. cheap. and easy way to put the feel of a bug back into our operating. and it can be done for less than five dollars!

However, before we spend that five dollars there is a minor problem to solve. Some of us already have single-lever paddles. which is what is needed to complete the electronic bug. As far as I know. all such paddles have grounded wipers. This circuit requires that the paddle have all three contacts floating—dot. dash. and wiper. Unless an existing paddle can be modified. it may be necessary to home-brew a single-lever paddle in order to take advantage of this project.

Fig. 1 illustrates the simple electronic portion of the single paddle bug. The circuit is not original with me. I started with a portion of a 25-year-old design by W7ZOI and made some modifications to get the results I

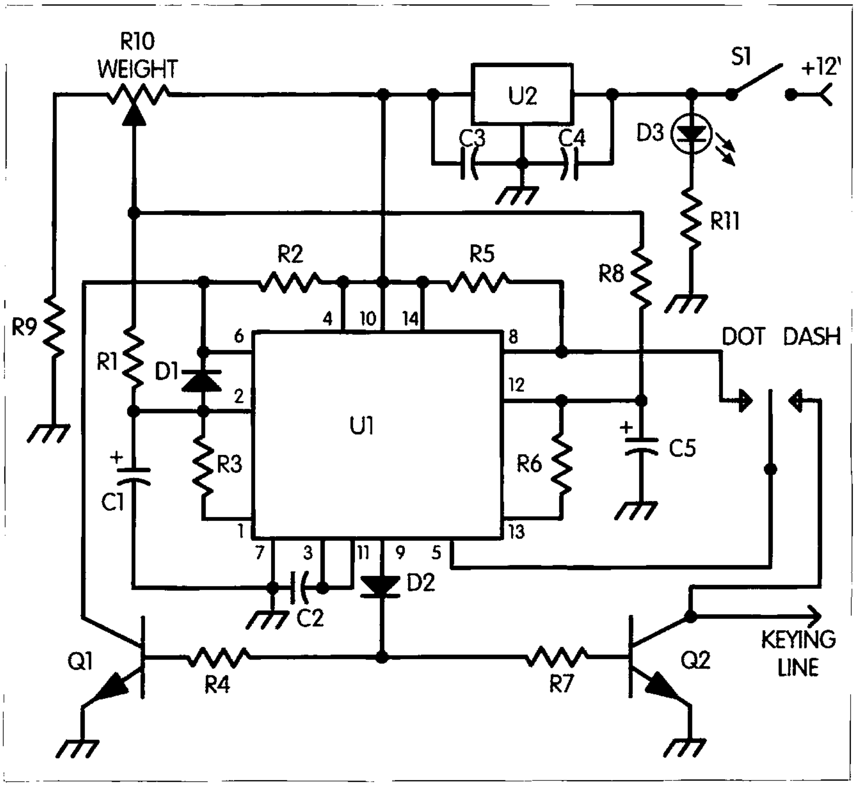


Fig. 1. Schematic of spaced dots generator.

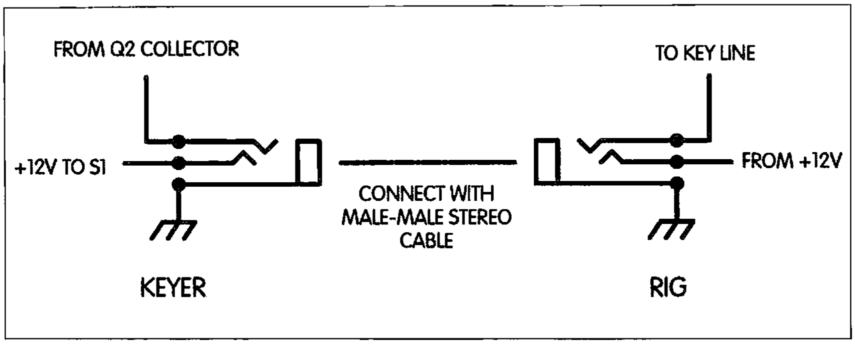


Fig. 2. Power and keying wiring.

needed. The original circuit was more complex and did things not needed in this final design.

Both timers in U1 together produce perfect dots and spaces, the speed of which is controlled by the weight potentiometer, R10, which serves the same purpose as moving the weight on a bug. When the paddle is pressed for dots, a stream of perfectly spaced dots is generated and keys the rig through Q2, the keying transistor. Dot speed is adjustable, as on a Vibroplex, from approximately three to 25 dots per second—equivalent to a keying speed range of seven to 60 wpm.

When the paddle is pressed for dashes, this is a "key down" condition exactly as in a bug, allowing the operator to make his own dashes and bringing back the familiar bug "feel." In addition, the dash side of the paddle can be tapped just as if it were a hand key for those times when it is necessary to key very slowly. Also, this function is retained even if the circuit is not powered.

Construction

The spaced dot generator can be constructed on a small piece of perfboard or a general-purpose printed circuit board, or you can use the "dead bug" style of ugly construction on a small piece of unetched printed circuit board. Parts placement and lead lengths are not critical. It can be mounted in a small enclosure, or possibly right on or inside the base of the paddle.

To reduce clutter, it will be preferable to solder three jumpers on the bottom of U1 before mounting it, whether a socket is used or not. Strip the insulation from a short length of stranded wire and separate the strands. Solder one strand between pins 4 and 10 on the bottom of the chip, making the soldered connections high on the pins of the chip, and clip off any extra lead lengths. Solder another jumper between pin 3 and pin 11. Place a small piece of cellophane tape on the bottom of the chip covering these two jumpers as insulation. Now solder a final jumper between pin 10 and pin 14 as before.

Power can be supplied by an internal battery or by taking operating voltage from the rig it will be used with. **Fig. 1** includes an optional On/Off switch and LED if an internal battery is used. In this case, you may or may not want to include the voltage regulator U2.

If taking power from the rig for operating this unit, a stereo jack must be added to the rig. It will carry +12 V, ground, and the keying line through a connecting cable. The ring carries the keying line, the tip carries +12 V, and the sleeve is common ground. **Fig. 2** illustrates using a stereo jack on both the dot maker and the rig, and connecting the two through a three-wire cable with stereo plugs on each end. However, the cable can be hard-wired into the electronic circuit and the stereo plug on the other end plugged into the new jack on the rig.

This circuit draws only about 10 mA with U2 installed. If you wish to have audio monitoring of your keying, perhaps for practice sessions, a small piezoelectric alarm can be connected directly between the +5 volt bus and the collector of Q2. This will add about 10 more milliamps to the total drain with key down.

Forward to the past

Now that you have your new electronic bug emulator, no one you QSO with will have any idea you aren't using a Vibroplex!

Parts List

C1, C5	1 µF 10 V
C2, C3, C4	0.1 µF disc or monolithic
D1, D2	1N4148, 1N914, or equivalent
D3	LED
Q1, Q2	NPN bipolar transistor (2N3904, 2N4400, 2N2222, etc.)
R1, R8	33 k 5% 1/4 W
R2, R5, R9	47 k 5% 1/4 W
R3, R6	100 5% 1/4 W
R4	10 k 5% 1/4 W
R7	2.2 k 5% 1/4 W
R10	10 k linear potentiometer
R11	2.4 k 5% 1/4 W
S1	SPST toggle or slide switch
U1	556 dual timer IC
U2	78L05 regulator

Table 1. Parts list.

Number 29 on your Feedback card

Seeing Dits and Dahs

The K2659 Morse Decoder Kit from Velleman Electronics

Marshall G. Emm N1FN
2460 S. Moline Way
Aurora CO 80014
[n1fn@MorseX.com]

As one whose ham activities are 95% HF CW, I have long held the view that when it comes to copying code, the human ear will beat a computer every time. An experienced CW operator can copy code that is barely audible, signals plagued with QRM, QRN, and QSB.

Computers need a good solid signal with a high signal-to-noise ratio. And when conditions *are* good enough for computers to copy Morse, there are far more efficient modes available to them. The Velleman Morse Decoder has done nothing to change my opinion, but it was fun to build and does indeed have some practical applications.

I saw the decoder kit at TechAmerica® where some 30 different Velleman kits are available (Velleman makes about 150 different kits), along with kits from several other suppliers. The Velleman kits are made in Belgium, and reflect an unusually high standard of packaging—the kits are in plastic boxes, which are useful for sorting parts during inventory and construction.

In many cases the box can be used as a permanent enclosure for the completed project.

How it works

The Morse Decoder kit includes a small microphone, which is placed near the speaker of a radio receiving a Morse code signal. The audio from the microphone goes through an A/D converter, which passes a digital signal to a microprocessor.

When the unit is correctly tuned, the digital signal is either on or off depending on whether a tone is being sent. Three pots are used to process the audio signal before conversion. They control the audio bandwidth, the center frequency of the audio bandwidth, and the sensitivity of the microphone. An LED is used in tuning, and blinks in time with the Morse signal when the unit is properly adjusted.

The processor analyzes the pattern of dots and dashes and interprets them as characters which are scrolled along a 16-character LCD display. The decoder recognizes the alphabetical characters, numbers 0–9, and most of the prosigns ordinarily used in CW traffic. The manual says the unit will read code at "almost any speed," and that's pretty much true.

How well it does all this is a matter of judgment, but I'll save my comments on performance for later.

Construction

The decoder kit was relatively easy to build, with step-by-step instructions in the manual. It took me about an hour to put the kit together. As is my usual practice, I installed the IC sockets first, even though the instructions don't have you do them until after the resistors and diodes. With nothing else on the board, so it will lie flat on the table, the sockets are a lot easier to manage.

The PC board was of very high quality, silk-screened with component layout on one side and solder-masked on the other. Generally I found the components to be of high quality and easy to identify, with the exception that some of the terms used for component types were not what I am used to in kits from US manufacturers. For example, there was one capacitor described as "100 nF MKM" and three described as "sibattit." Fortunately, the parts count was low enough that these were quickly identified, even though the MKM proved to require the tail end of the process of elimination. Last one left? Fits the spot? Must be it!

All of the axial-lead components ("flat" resistors, diodes, etc.) were supplied mounted on a single "ammo strip," and—get this—they were on

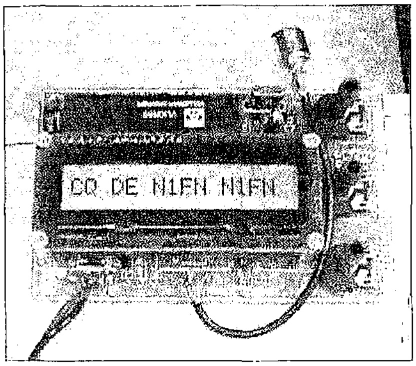


Photo A. Test-driving the "send" setup.

the strip in the order in which they were called for in construction. That sure made it a lot easier to find the components when they were needed!

The installation of the LCD display was a bit tricky, as was the LED. The display is mounted above the main board on metal stand-offs, and is connected by 14 plain wires (supplied on the ammo strip!) which go through a hole in the display and then through a hole in the circuit board, and are soldered in both places. I discovered that the spacing of the wires on the ammo strip was such that every other wire matched a pair of holes, so I cut them apart, leaving seven wires still attached by one side of the ammo strip. I fed them through the odd holes in the display and down through the circuit board, and the remaining piece of ammo strip tape held them in place while I soldered them on the circuit board. Then it was a simple process of trimming the leads above the LCD display and soldering that end, and finally repeating the process for the remaining seven wires in the even holes.

The instructions for the LED read, "The upper side of the LED should slightly overlap the display." That took me a minute or two to figure out, but what it means is that the LEDs are inserted only a little way into the holes so that the top of the LED is flush with or a little higher than the top surface of the display. Now that I think about it, I'm not sure how I would have described it myself!

The instructions tell you to connect the microphone using a "screened cable," but the manual's illustration shows the microphone soldered direct to its connecting pins on the front side of the circuit board. It seemed reasonable to me that you would want to put the display between yourself and the audio source, so a microphone on the back of the unit would make more sense than on the front. I used shielded audio cable long enough to locate the microphone at the back of the reader.

No real problems were encountered in construction, but I mention the component ID and documentation situations because I can imagine that these could be serious problems in a more complex kit.

The smoke test

The power supply for the decoder kit can be either a small transformer providing 7–8 VAC at 250 mA (there is a rectifier circuit on board) or DC at 9–12 V. The circuit includes a voltage regulator, so I connected my 13.8 VDC shack supply without further consideration. Actually, there was a little consideration necessary because they tell you to connect power, but not exactly where. There are three pins, marked VA, VB, and a symbol. A quick look at the board and the schematic should tell you that the symbol indicates the common or ground terminal, the VA and VB pins are both used if you are connecting an AC supply, and +DC can be connected to either VA or VB. There is no on/off switch. As soon as power is connected, the display reads "VELLEMAN KIT," and you can use a small trimpot to adjust the contrast. At that point you are ready to place the microphone near your radio and start to copy code.

The Morse Decoder in operation

Again, the documentation is rudimentary at best. Which is unfortunate, because the decoder is not particularly easy to use. They give you starting settings for the three controls, and then have you adjust them until the LED flashes and the decoded text is displayed. The adjustment can take a few attempts but you get used to doing it with a little practice.

There are some things they could tell you that would make life a lot easier. For example:

•A character is not displayed until the following character has been sent, or after about three seconds of silence.

•The unit takes a considerable amount of time to synchronize to the speed of the received code. When the speed changes, meaningless characters will be displayed for several seconds until the decoder can re-synch. This seems to be less of a problem when speed is increased. When the speed is decreased, you will often see the individual elements of characters sent as an endless stream of Es and Ts. Sometimes, in fact, it seems the unit will never re-synch unless you disconnect the power and let the processor start over.

There is nothing in the documentation to indicate how non-alphanumeric characters and punctuation (periods, commas, and question marks) will be displayed. An unrecognized character will be displayed as an asterisk. For the record, here's the list, as far as I was able to determine from trial and error:

Sign	Displayed As
BT	=
HH	% (error sign)
CT	[
AR	e
AS	w
KN	*
SOS	*

Table 1. Key to the signs that appear in the display.

•I was able to verify correct code reading at speeds from 7 wpm to around 50 wpm, using the sidetone on my electronic keyer and a test message sent repetitively from the keyer's memory. At the upper end of that range, an increase in sending speed required two or three repetitions of the message before the decoder would synchronize. A reduction in speed

Continued on page 56

Low-Voltage Detector

...for a number of uses.

Hugh Wells W6WTU
1411 18th Street
Manhattan Beach CA 90266-4025

Recently, a friend asked me to assist him in developing a circuit that he could use on a car battery-powered system that he has installed in his ham shack. The battery operation, in his specific application, provides power to his electric door locks, alarm system, enunciator, ham gear and other items. The 12 volts from the car battery is bused throughout his house and shop. Because the battery is the central power source for a multitude of critical systems, the health of the battery is extremely important. Under most circumstances car batteries and chargers are quite reliable, but there are occasions when a power failure may occur. Dislodging the charger's power cord or having a commercial power loss happens more often than we'd like to admit. Also, car batteries fail upon occasion—and seldom give any warning.

My friend asked if a project could be developed to provide a warning because his system did fail, when the charger became unplugged. The problem went undetected until *everything* failed, including his door lock control. After studying the variables involved in a battery-operated system, we determined that the most predominant failure mode is a loss of terminal voltage, which is easily detected. Because my friend's 12-volt system is bused everywhere, warning detectors could be placed in strategic locations where at least one would be observed, should a failure occur.

The devised circuit is simply a voltage comparator driving an LED. What could be simpler? During the development of the circuit, many threshold detector designs were considered and all would have worked well. The design selected for my friend's application is shown in **Fig. 1**. The criteria used for selecting the circuit required a variable threshold adjustment and a circuit that would drive an LED. The use of an audible alarm

Continued on page 38

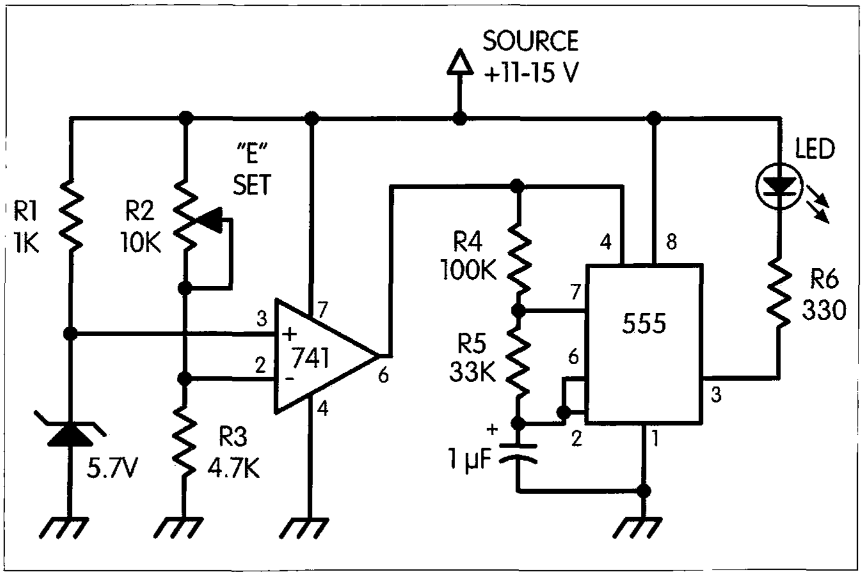


Fig. 1. Low battery voltage detector.

George's XE-lent Adventure

Part 2: Days 10–18.

George Pataki WB2AQC
84-47 Kendrick Place
Jamaica NY 11432

Tuesday. The *Radio Club Azteca* doesn't have its own place, so it holds its meetings twice a month at the Federation. Not having its own place, it doesn't have a station, but it does have a beautiful QSL card: XE1RCA. However, this does not compensate for those XEs who have stations, do operate, and promise QSL cards—when they don't even have one.

Founded in 1932, *Azteca* is the oldest amateur radio club in Mexico City, presently having about 30 members. Once a year, the club organizes a national contest. Theodoro XE1YQQ and Rosa XE1YQR drove me to the Federation in the evening. There I met Memo XE1NJ, the director of IARU region 2, area C, and the executive secretary of the Federation. Memo, a building administrator, was licensed in 1978; he is a DXer with 317 countries confirmed, and works only SSB on 10-15-20 meters. His wife Rebeca is XE1RUN and she is active. His son Memo Jr. is XE1OJ, and his daughter Ady is XE1NG—both are inactive.


Photo A. *At the XE1LM club station, standing, left to right: Efraim XE1JGM, Manuel XE1JRI, Arturo XE1NAD, Carlos XE1FOX. Sitting, left to right: Felipe XE1MHF, Jean-Pierre XE1YVE, Emir XE1PAR.*

In 1985, Memo participated in the DXpedition to Revillagigedo when the XF4MDX call was used.

We met some of the members of the *Azteca* radio club (**Photo A**). First to arrive was Arturo XE1NAD, the club's president (**Photo B**). Every year they have an election for president and you can be re-elected just once. I visited his station the next day.

I also met Felipe XE1MHF. He works in the printing industry, was licensed in 1990, and operates only on SSB, mostly on two meters. His wife Olga XE1XZT was licensed in 1996.

Jean-Pierre XE1YVE is a French-born electronics engineer, licensed in 1988; Emir XE1PAR is a retired doctor who—despite his name—does not have a harem. I visited Emir three days later.

Manuel XE1JRI sells and installs computers, and trains the users. I saw him and his family of amateurs the following Saturday.

Photo B. Arturo XE1NAD, president of the Radio Club Azteca, is active on satellites on 144/432 MHz and on 6 m with a rotatable dipole.

Carlos XE1FOX is assistant director of IARU, region 2, area C, and also director of the Federation. Carlos works in advertising. He is a DXer, works only SSB, and has over 200 countries confirmed.

Efraim XE1JGM, is a past president of the club; I had visited him three days earlier.

I took some group photos at the XE1LM club station (the one that seems not to have QSL cards), said *"Hasta la vista,"* and returned to my hotel.

Wednesday

In the morning, Arturo XE1NAD, the president of the *Radio Club Azteca*, picked me up from the hotel and took me to see his station. Arturo, a physicist, is the system manager for Penoles, the world's largest silver-mining company. Arturo is very enthusiastic about amateur radio and has plenty of excellent equipment. He was licensed in 1994; operates SSB, RTTY and satellites; and has a nice QSL card. He has a 40-foot tower on the roof, 120 feet from the ground. On that tower, Arturo has a three-element monobander for 10 meters; a three-element TH3-Jr that is a three-element yagi for 10-15-20 meters; and a two-element yagi for 40 meters. He also has a rotatable dipole for 17 meters and a rotatable dipole for six meters. Furthermore, a G5RV is used for 10 to 80 meters and, with a tuner, for 160 meters.

Arturo is working satellites on two meters and 70 cm, in the B mode, and is planning a setup with a 1.2 GHz for uplink and a 2.4 GHz for downlink, operating on S mode. Arturo XE1NAD is a contester; he created his own contest computer program. In his car, he has a dualband mobile rig for 144 MHz and 432 MHz. Arturo is also an excellent amateur photographer, and in martial arts he has a black belt, second *dan*. His E-mail address is: [arturo_enriquez@penoles.com.mx].

Arturo took me to the office of Luis XE1L, in a beautiful Spanish-style building surrounded by tall office buildings. It is easy to find Luis' building because it has a tower with a large yagi on the top.

Luis took me to see Lorenzo XE1U, who has a Ph.D. in civil engineering but works in insurance as the vice president of *La LatinoAmericana* (**Photo C**). Lorenzo is fluent in English, French, and Italian, and besides

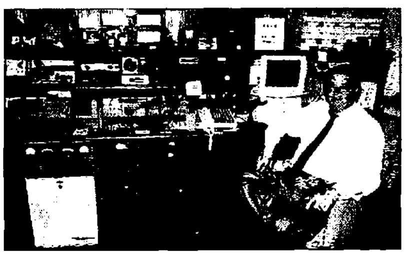


Photo C. Lorenzo XE1U has two great stations: one in Mexico City, the other in Tepotzotlan.

Photo D. Reyna XE1LMV and her mother, Olga XE1NBJ.

Spanish, he also speaks a dialect used in the Canary Islands. Licensed in 1969, Lorenzo has a tremendous station, but is not a DXer; he works only SSB mostly with friends. His tower is 66 feet from the roof, 90 feet from the ground. On the tower Lorenzo has a 30-element, vertically-polarized yagi for two meters; a TA-33-40 yagi for 10-15-20-40 meters; a wire dipole for 40 and 80 meters; and three verticals for 144 MHz, 432 MHz, and 1.2 GHz. He likes 40-meter SSB. And to top it all off, he has a separate room just for constructing.

In Tepotzotlan, he has a second house with a complete station: an 82-foot tower with a 30-element yagi for two meters; a TH7DX type of antenna which is a seven-element yagi for 10-15-20 meters; a two-element yagi for 40 meters; and an 18HTS vertical from Hy-Gain for 10 to 160 meters. Lorenzo XE1U has a nice, colorful QSL card.

Thursday

For this day I had scheduled a visit with a ham who did not show up and did not even call to cancel the appointment. I went people-watching, and again to the two large artisans' markets. I prefer to shop where there are fixed prices; I really don't like haggling. As a dilettante in bargaining, I am no match for the professionals. No matter how much time I spend checking out prices and trying to push them down, after making the purchase, I always find better buys. That is the reason I prefer to do my shopping on the last day of my trip—at least then I don't see that I have made bad deals.

Some merchants spoke some English, but many of them, even after dealing for years with foreign—mostly American—tourists, knew very little. When asked about prices, they showed them to me on their calculators.

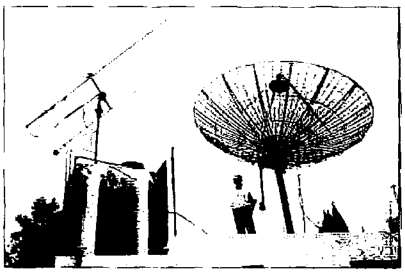


Photo E. Max XE1XA, with his antennas for satellite and EME communications.

Friday

Today Emir XE1PAR came to the hotel and took me to his house. Emir is a retired medical doctor who worked as a hospital administrator. He was licensed in 1984. His daughter, Maria-Eugenia XE1PAT, is an architect living in Leon Guanahuato; they have QSOs every day on 40-meter phone.

Emir has a 40-foot tower on his roof, which itself is 33 feet from the ground. His antennas are: a six-element yagi for 10-15-20 meters; a Ringo for two meters; a Diamond for two meters and 70 cm; and a wire dipole with traps for 40 and 80 meters.

Emir XE1PAR has a second house in the state of Morelos, where he takes his Kenwood TS-440 or his Drake TR-3 to use with a wire dipole. Emir has QSL cards.

In the afternoon, I took a taxi to see Nellie XE1CI, who lives in a very high-class section of the town. The taxi driver stopped four times to ask for directions; twice he was sent the wrong way. To enter the building, I had to pass two security checks. When I got to the lobby and entered the elevator and pushed the button for the fifth (Nellie's) floor, the elevator went down instead of up because the lobby is on the eighth floor. That really can confuse a burglar!

If you talk about Mexican YLs or Mexican DXpeditioners, then you talk about Nellie XE1CI. She was licensed in 1968; her late husband Max XE1TX was also a very active amateur. Her three daughters and their husbands are also hams: Patricia XE1TX, who got her father's call; Debora XE1XYZ; and Lorena XE1XYW. They are not as active as Nellie XE1CI, but who is?

Nellie's tower is 165 feet from the ground and has a 30-foot mast. She has the following antennas: an omnidirectional two-meter vertical on the top; a 12- or 24-element (she did not remember exactly) vertically-polarized yagi for two meters; a TH11DX yagi from Hy-Gain for 10-12-15-17-20-30 meters; a Cushcraft two-element yagi for 40 meters; and an inverted-V wire dipole for 80 meters. Nellie XE1CI works on SSB, RTTY and satellite. She is on the No. 1 Honor Roll and has the 5BWAS with YLs only.

In Nellie's radio room, among all kinds of interesting ham memorabilia, I saw a dedicated photograph of JY1, King Hussein of Jordan.

Nellie has operated in many DXpeditions and from many locations, such as Easter Island XRØY; Revillagigedo XF4CI; Jordan YJ8XE; Israel 4X/XE1CI; Guantanamo Bay KG4CI; Puerto Rico XE1CI/KP4; Belize V31CK; Grenada J37NL; St. Pierre FP/XE1CI; British Virgin Islands VP2V/XE1CI; as well as in Venezuela; Germany; Sweden; Hilton Head Island IOTA NA-110; Isla del Carmen in XE3; etc., etc. Her E-mail address is: [xe1ci@mail.internet.com.mx].

Saturday

Manuel XE1JRI, whom I had just met at the *Radio Club Azteca* meeting, came to get me and take me to his house, where I met his spouse Olga XE1NBJ, and their pretty daughter

Photo F. Vic XE1VIC is on the Honor Rolls for Phone and Mixed, No. 1 Honor Roll, 5BWAZ, 5BWAS, etc.

Reyna XE1LMV, who was just finishing college (**Photo D**). All three were licensed in 1992.

Manuel XE1JRI is the most active ham in the family; Olga XE1NBJ is mike-shy and Reyna is busy with her studies. They have a small station and a wire dipole for 40 and 80 meters, but no QSL cards. Their QSOs are virtually only with Mexican stations. The standard excuse for not working DX is that they do not speak a foreign language. This may be so in the case of Olga, but Manuel speaks enough English to be able to use it in QSOs, and Reyna's English is even better. Besides, there are a great number of countries in Central and South America where the hams do speak Spanish, so I wish the Mexican amateurs would get over this presumed language barrier and start to talk with the world.

Manuel XE1JRI is active in public service communications; he relayed messages after various hurricanes destroyed part of the public communications system. The Mexican amateurs have drills preparing them for potential disasters created by earthquakes, hurricanes, and the possible eruption of the Popocatepetl volcano. Once a year, Manuel participates in the Boy Scouts Jamboree demonstrating amateur radio communications to children.

We agreed to meet with Max XE1XA (**Photo E**) in a restaurant, halfway between Manuel's and Max's houses. They had never met before, but hams can always find each other. So we met, and I went with Max. First, we went to the house of Vic XE1VIC (**Photo F**). Vic is an accountant; he was licensed in 1978 and is one of Mexico's Big Guns. He has a very big station with lots of equipment. His tower is 75 feet high from the roof, 95 feet from the ground. It supports a TH7DX which is a seven-element yagi for 10-15-20 meters; a two-element yagi for 40 meters from Cushcraft; a G5RV for 10 to 80 meters; a Butternut vertical for 40-80-160 meters; a shortened wire dipole for 160 meters; and an inverted-L for 160 meters. He can also resonate his tower on 160 meters. No wonder he has over 100 countries worked on this band. Vic has a nice

***Photo G.** Marisa XE1IRF and her daughter, Mariza XE1JVF.*

QSL card. What was surprising is that Vic does not use computers—he does not like them.

A member of the Mexico DX Association and Mexico DX Club, Vic XE1VIC is on the No. 1 Honor Roll, has both Phone and Mixed, and has 5BWAZ, 5BWAS, 160WAS, and scores of other awards difficult to obtain. He has twice gone on DXpeditions—to XF4 Revillagigedo and to 4J1 Malyj Vysotskij.

I saw that Vic's house, like many others in upper class neighborhoods, is protected by pulsating high voltage, among other devices. I wonder if that creates any radio noise.

After finishing at Vic's place, we went to see the station of Max XE1XA. Born in Italy, Max came to Mexico for a visit and then decided to stay. He manufactures medical equipment and various electronic parts and assemblies.

His tower is 40 feet from the roof, and 53 feet from the ground. It has an eight-element yagi for two meters and a TA33, a three-element yagi for 10-15-20 meters. His claim to fame is his satellite activities; he has made thousands of QSOs with over 100 countries using a 16-element cross-yagi for two meters, and a 40-element cross-yagi for 70 cm. Furthermore, Max XE1XA is known for his EME work. With his home-made dish, 16.5 feet in diameter with a 24 dB gain on 70 cm, Max has made hundreds of QSOs with 28 different countries. He has been a member of AMSAT since 1974, and has had articles published in the *AMSAT Journal*. His main interest is building equipment for very low level signals. Max has a nice QSL card.

In April 1989, Max XE1XA made the first satellite operation from Revillagigedo, making 521 contacts. He also operated via satellite during the Easter Island XRØY DXpedition, making 431 QSOs with 41 countries, uplink 70 cm, downlink two meters. He was part of the group who made the first six-meter EME contact from Easter Island.

Max's E-mail address is: [coramexsa @supernet.com.mx].

I returned to my hotel to rest, but then I got a call from Manuel XE1JRI that he had found some more hams willing to be photographed. I could not miss the opportunity. Manuel came over and drove me to the home of Roberto XE1NDN, an orthopedist. A family of four, all hams! Roberto XE1NDN was licensed in 1990; his wife Marisa XE1IRF, a kindergarten teacher, licensed in 1992; his daughter Mariza XE1JVF, a university student studying business administration, licensed in 1992 (**Photo G**); and son Roberto XE1JRS, a salesman, licensed also in 1992. I have noticed the tendency in many families to give the children the same first names the parents have.

Roberto XE1NDN was saying that he has to have three jobs to support his family. I told him that in the US medical doctors make quite a lot of money, and the best season for orthopedists is winter, when people slip and fall on ice, and break some bones. In Mexico, there is little chance for ice. "Oh," said Roberto, "Santa Patineta takes care of us orthopedists!" He was referring to accidents caused by children on roller skates.

Here I found hams acting more like CBers: no logs; no QSLs; only short distance contacts, mostly with friends, without trying to extend their radio communications to faraway places in other countries. Again, the unjustified excuse was that they don't speak foreign languages. Roberto XE1NDN has a computer, but does not use it to its full capabilities, for example, to log his QSOs. After taking their pictures I returned to my hotel wishing I could go home—but according to my schedule and airline tickets I had two more days to stay.

Sunday

In the morning I went with Theodoro XE1YQQ and Rosa XE1YQR to a big market which had two distinct sections: one with the usual new clothing; and the other one, a real flea market with genuine antiques which I have rarely seen in other places. I did not buy anything, but it was fun to look at them.

In the afternoon, all three of us went to *Palacio de Bellas Artes*, a few blocks from my hotel, and saw four very well executed and imaginative modern dances presented by the *Compania Nacional de Danza*. I especially liked the ballet created to the music by Georges Bizet, on the theme of Carmen. It was fantastic. The best seat in the house costs about 14 dollars.

The Palace of Fine Arts, an architectural masterpiece, had a painting exhibition with the works of Diego Rivera, his wife Frida Kahlo, Siqueros, Orozco, and other great Mexican artists.

Monday

The end of my trip was approaching. I did the last-minute shopping and I took everything I bought to Theodoro's hardware store, where they packed it in two cardboard boxes that were later taken to my hotel.

During the last few days, I had gotten sick of the spaghetti I had eaten almost daily. I had not wanted to adventure in typical Mexican food, so I had bought in the market the bread, cheese, and tomatoes that I would eat three times a day.

I noticed some peculiarities in Mexico City. The subway, which has a very extensive network, is very cheap: 1.5 pesos, which comes to 18 cents. However, the highway tolls are much too expensive. Going to Cuernavaca we paid 50 pesos each way for about an hour's drive.

On the streets of Mexico City, especially in the business districts, there are men with red flags, some with a large letter E, others without it or just with a piece of rag, jumping around and waving their flags to get the attention of the drivers and attract them to

their parking garages. The letter E stands for *estacionamiento*.

Buses and minibuses often have a man standing in the open front door yelling out the route and inviting passengers to get on.

The traffic is tremendous and noisy, with impatient drivers blasting their horns, cops blowing their whistles, and scores of cars crossing the intersections after the lights turn red.

Tuesday

I took a whole-day tour going to Puebla and the pyramid of Cholula. Puebla has 3,000,000 inhabitants. There we visited the Hidden Convent of Santa Monica, filled to the brim with religious paintings and carvings. Just on the two tours alone that I have taken, I have been to so many churches, chapels, and convents, and bowed my head in front of so many crosses and various saints, that I now believe I have earned my place in Heaven.

As usual, the guide took us to a "factory," this time to a "Talavera ceramic factory." During my travels, when I took tours I was taken to many, many "factories" but never saw a worker; the "factories" were just stores only for foreign tourists, where the guide gets a commission on everything his group buys, and that makes the prices higher than if you shop by yourself.

Another bit of information: For absolutely the same tour, various travel agencies charge different prices. For example, I found three brochures from three agencies asking for the above tour $35, $43, and $46. Why do I say that it is the same tour? Because instead of sending three buses with three drivers and three guides, they combine everybody in a single bus, no matter where you booked the tour and how much you paid. I paid $43 (silly me) and a guy sitting near me paid $35. So, collect all the tour brochures you can find, decide on a tour, and book the cheapest one.

Wednesday

I had return tickets for an afternoon flight, but I went to the airport early in the morning and changed my tickets for an earlier flight. I had kind of finished my job and run out of money, and it was very hot. I was anxious to get home.

At the Dallas/Ft. Worth airport, I had to pass immigration and customs and change planes. I was the lucky winner of perhaps a random selection by the customs officials and they checked not only all three pieces of my luggage, but also I had to hand them my jacket for inspection. They examined it carefully, even the books I was carrying: *DX-Aku, Messages from the Easter Island Expedition*; and *VKØIR*; both by KK6EK, received as gifts from Luis XE1L.

I believe it was not a routine customs inspection. Initially I had had the intention of taking a side trip to Cuba to visit some hams, and that is forbidden because of the embargo. I had told this

to a couple of people. Perhaps word got around and the authorities were waiting for me. I certainly do not match the profile of a smuggler, and they could have brought their sniffing dogs to check me out. But the dogs wouldn't find any proof that I was in a forbidden place. For that, sniffing people were needed. Let me express my restrained opinion about the embargo: it is completely useless, and is restricting the freedom of US citizens to travel wherever they want.

I truly enjoyed the trip, despite the unusually hot weather. I met really nice amateurs and non-amateurs alike. Mexico has everything—and even more than you could expect on a vacation. And you don't even have to cross the pond to get there; it is right in our own backyard! 73

Low-Voltage Detector

continued from page 31

sounder was rejected in this application even though the circuit is capable of driving a Sonalert™ or similar sounder.

An LM741 op amp was chosen to be used as the detector because of its availability and low cost, not for any specific technical reason. Yes, a voltage comparator, which was designed for the purpose, would work equally as well in this application. As a matter of fact, if you decided to use a voltage comparator, there would be no changes to the circuit except for the device pin numbers.

A zener diode is used to establish a stable voltage reference at a convenient voltage level between 4.5 V and 8 V and is connected to pin 3 of the LM741. Also, the voltage at pin 2 of the LM741 must be adjustable above and below the zener value in order to achieve a detection threshold level. The voltage value on pin 2 normally remains higher than the voltage on pin 3, and as long as it is higher, the output at pin 6 will remain low. Potentiometer R2 is adjusted to allow the voltage at pin 6 to rise when the supply voltage falls to and/or below a selected level. In my friend's situation the threshold voltage was set for 11 volts. At that value his critical functions would still continue to operate while the flashing LED would provide a warning of a potential failure.

Although turning on a light *is* a warning, a steady glow might not be noticed. A flashing light has a much better chance of attracting attention to a potential problem. To make a flashing light, a 555 IC was used as a low-frequency oscillator for controlling the LED on/off function. An LED with a built-in flasher would perform just as well in this application, and would simplify the circuit by eliminating the 555. The actual flash rate is not critical as long as it attracts attention.

There is nothing critical in the construction of the low voltage detector. Adjustment of the threshold is performed by attaching the detector to a variable voltage power supply. The output of the supply is adjusted to the desired detection voltage threshold value. Then, R2 on the detector is adjusted until the LED begins to flash. The correct setting is then verified by raising the supply voltage slightly above the threshold until the LED stops flashing. The supply voltage is then lowered until the LED starts flashing again.

The low voltage detector can be used for a wide variety of applications—you are limited only by your imagination. It's suitable for use on any battery-operated system subject to a voltage loss situation, including an automobile. Build the circuit and try it out on your 12-volt battery and/or power supply system. 73

Parts List

R1	1 k 1/4 W resistor Jameco #29663
R2	10 k pot Jameco #43001 Hosfelt #38-120, #38-145, #38-192
R3	4.7 k 1/4 W resistor Jameco #31026
R4	100 k 1/4 W resistor Jameco #29997
R5	33 k 1/4 W resistor Jameco #30841
R6	330 1/4 W resistor Jameco #30867
C1	1 µF 50 V radial cap Jameco #29831 Hosfelt #15-550
Zener	1N4734 (4.5–8 V) Jameco #36118 NTE #5013A
U1	LM741 op amp Jameco #24539 Hosfelt #LM741CN RS #276-007
U2	555 timer Jameco #27422 Hosfelt #NE555
LED	red LED Jameco #94511, #94529, #104248 Hosfelt #LO1, #25-307, #25-325 RS #276-041

Table 1. *Parts list for the low battery voltage detector, including part numbers of suppliers.*

SPECIAL EVENTS

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March '99 issue, we should receive it by December 31. Provide a clear, concise summary of the essential details about your Special Event.

JAN 2

MORRISTOWN, TN The Lakeway ARC will host a Hamfest and Computer Show on Jan. 2, 1999, at the Talley Ward Rec. building in Morristown TN. For info please contact *Perry Hensley N4PH, (423) 828-4848, E-mail [n4ph@juno.com]; Kemp Lawson KF4AGB, (423) 587-3320, E-mail [kemp-lawson@aol.com];* or write to *Lakeway ARC KF4JJJ, P.O. Box 895, Talbott TN 37877-0985.* Talk-in on 147.030(+) and 53.030(-).

JAN 16

ST. JOSEPH, MO The Missouri Valley ARC and Ray-Clay ARC will hold their 9th annual Northwest Missouri Winter Hamfest 8 a.m.–3 p.m. at the Ramada Inn, I-29 and Frederick Ave. (Exit 47 on I-29), in St. Joseph MO. There will be special room rates for hamfest participants. VE exams, major exhibitors and flea market all indoors. Free parking. Advance tickets $2 each or 3 for $5; at the door $3 each or 2 for $5. Pre-registration requests received after Jan. 5, 1999, will be held at the door. Dealers: Swap tables $10 each for the first two tables. Commercial exhibitors welcome, write for details: *Northwest Missouri Winter Hamfest, c/o Gaylen Pearson WBØW, P.O. Box 1533, St. Joseph MO 64502, or E-mail [WBØW@IBM.Net].*

JAN 17

HAZEL PARK, MI The Hazel Park ARC will hold its 33rd Annual Swap & Shop on Jan. 17, 1999, at the Hazel Park High School, 23400 Hughes St., Hazel Park MI. The public is welcome 8 a.m.–2 p.m. General admission is $5 in advance or at the door. Plenty of free parking. Tables $14; reservations for tables must be received with a check. No reservations by phone. Talk-in on 146.64(-), the DART rptr. For info about the swap, tickets, or table reservations, mail to *HPARC, P.O. Box 368, Hazel Park MI 48030.*

SPECIAL EVENT STATIONS

DEC 13

AURORA, CO The Second First Annual Great Colorado Snowshoe Run, sponsored by the Colorado QRP Club, will be on the air 0300Z–0500Z December 13th, 1998. This equals Dec. 12th in the following time zones: 7 p.m.–9 p.m. Pacific; 8 p.m.–10 p.m. Mountain; 9 p.m.–11 p.m. Central; 10 p.m.–12 midnight Eastern. 40 meter CW only, 7.040±. Power: 5 watts maximum for all entrants, but QRO stations can be worked for credit. Certificates will be awarded to the highest scoring station in each antenna class, and the highest scoring station in each SPC. Full details are on the CQC Web site at [http://www.cqc.org], or E-mail [cqccx@cqc.org]. Up to three contacts with the same station are allowed, 30 minutes apart. Logs must be postmarked or E-mailed no later than 30 days after the event. Mail to Colorado QRP Club, Inc., P.O. Box 371883, Denver CO 80237-1883, or E-mail (ASCII text files only) to: [cqccx@cqc.org].

JAN 26–27

ST. LOUIS, MO All Amateur Radio Clubs of St. Louis MO will sponsor Special Event Station WØK during the papal visit of Pope John Paul II, Jan. 26–27, 1999. Operations from the Monsanto Amateur Radio Assn. shack will be on 10–80 meters, 24 hours per day. QSL with #10 SASE via *Rev. Mike Dieckmann KAØIAR, 703 Third St., Hillsboro MO 63050 USA.*

Number 39 on your Feedback card

ABOVE & BEYOND

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119
[clhough@pacbell.net]

HP power meters and thermistor mounts: Evaluating surplus material

Due to several requests for an overview covering Hewlett-Packard and similar microwave power meters, I will re-explore power meters and how to evaluate them at a swap meet to attempt to avoid spending big bucks on a defective unit. Most important is the evaluation of the power head, as this is the most important piece of equipment in the evaluation equation.

There are several tricks of the trade that can be brought to bear to evaluate surplus material "on the fly" at swap meets and other events we microwavers delight in. For one thing, I usually carry (in the glovebox of the car) a suitable set of simple tools to help in testing should the opportunity present itself.

The first item I want to cover is just what to pay for surplus power meters and—most important—the RF head and connecting cables. Other questions to answer include what conditions

to expect and how you know if something is in working condition. I know we need a set of test parameters through which to put a device to avoid the purchase of another doorstop. Well, I can't guarantee you that these pointers will be 100% perfect, but perhaps they will help to minimize any aggravation.

I am basing my observations here on the Hewlett-Packard 431-type power meter with matching RF cable and 478-type power meter head, which is the most common. There are several other types of meters, such as those by General Instruments. I picked the Hewlett-Packard 431 because it is an inexpensive surplus meter that seems to be prevalent on the surplus market.

When you happen upon a power meter at a swap meet or flea market, it's kind of hard to really evaluate it in its operational state unless you have AC power and a source of RF to fully test it. However, there are some basic operations you may perform on the unit to determine if it is indeed "alive."

In this example, our HP-431/HP-478 system should be able to measure frequencies from 10 MHz to over 12.4 GHz with ease and accuracy using the "N" coaxial connector of the 478A power head. Other heads are available with waveguide instead of coaxial input connectors. The 478A coaxial head is the most popular, as it has the most common frequency range of use. However 10 and 18 GHz waveguide heads are very good also.

The division of cost can be split up into the three components of the HP-431 power meter system. First, the meter itself is valued at $25 to $40: it is readily available as a stand-alone device—but it is useless without the control cable and power head (478A), which are the two more expensive parts of the systems. The RF head cable is valued at $40 and the power head, type 478A, slightly higher at $50, making a package price in the $150 range somewhat common. I have seen meters with cables and 478 heads priced at over $200, but they still reappear month after month with no one purchasing them at swap meets here.

Don't rush to pick up a meter. First get a cable, and if you want to check it, a simple ohmmeter check of continuity will do the job. I have never found a surplus cable defective—just very dirty, and sometimes with cracked cable covering (fixable with a little black electrical tape). Didn't look very swift, but it functioned well. If you're a purist, get some gray electrical tape and do the best you can.

Recently I evaluated three power heads with a waveguide input for the frequency range of 12.4 to 18 GHz and found only one suitable for purchase. I also applied the same techniques to evaluate seven coaxial General Microwave power heads and found them all defective. They all carried sticker prices of $40 each—not too bad for a doorstop. Just don't let your pick-it-up-itis get in the way of reason—evaluate what you are contemplating purchasing.

The cost of a complete power meter package with cord and thermistor mount should be less than $200. A setup like this can measure power from 10 MHz to over 12.4 GHz with ease and accuracy, using a terminating "N" coaxial connector. I have also seen systems go for a lot less, with $125 or so being more commonplace. Remember, there are a lot more 431-type meters around than cords and the scarce thermistor heads. Thermistor heads can go for $80 to $100 each depending on condition (appearance). If you're desperate and have a bankroll, well, judge it for yourself. I would purchase a lower-priced head providing I could test it with an ohmmeter. Used, good, checked-out-but-grungy-appearance heads demand the lower figure, while new checked-out heads command the top price at swap meets. This is somewhat backward from a calibration standpoint, which would make more sense to me.

Evaluation at swap meets can be difficult, but if there is AC power you can plug in the meter and see if you can make DC balance with the RF head attached. (Set the meter's resistance switch on the front panel to 200 ohms when using the 478A RF head.) Adjust the meter balance controls for zero indication using both the coarse and fine balance potentiometers. Usually, if a power meter will balance, it's in reasonable condition.

While in the AC power mode, pull out your little RF test generator to make an on-scale reading. It's a single TTL high frequency crystal oscillator module and its 9 V transistor radio battery. The unit I built is quite small, and only uses eight components, including a crystal oscillator module, a nine-volt battery, five-volt zener with load resistor, and three resistors in the output attenuator circuit to limit output to zero dBm or so.

If AC power is not available, you can still confirm several good test conditions to determine if it indeed is a bargain. What you want to determine is whether the RF thermistor head is "alive." To accomplish this, we make a DC resistance check of the thermistors in the 478A thermistor mount. For these measurements, you need an older-style POVM—that's a Plain Old Volt Meter, or more exactly a VOM, analog- or digital-type. The new digital types work, but with autoranging you don't get repeatable results. What is desirable is a range setting like x10 that does not provide high current output like the x1 scale, or the higher voltages used when in the megohm ranges. The times ten scale of an analog resistance meter (VOM) is perfect.

Make a DC resistance check between the shell (ground) of the HP-478A thermistor head and the pins that would connect to the meter's cord. You will find one pin open and three pins connected to ground. The remaining two pins are direct connections to the thermistor leads. Pins 1 and 3 are the thermistor's to-ground. Pins 2, 4, and 6 are grounds. Pin 5 is open. One of the thermistors is the actual RF thermistor that responds to RF power, and the other is isolated and is used to provide temperature stability balance to the bridge circuit. Both thermistors must be matched to balance the power meter bridge circuit. I measured on my bench this way and got 3.22 k ohms on pin 1 and 3.75 k ohms on pin 3. This unit just would not balance on the power meter. A better head measured 2.96 ohms on pin 1 and 3.01 ohms on pin 3 and balanced perfectly with lots of balanced range.

In desperation, heads can be fixed by adding some extra balanced resistance to the part of the thermistor circuit that is unbalanced (inside the 431 meter). Of course, calibration will be affected, but you get a balanced unit when there is no other possible fix available. It's not too bad, considering the alternative without any meter at all. This is a drastic last step to tide you over until you can get a good balanced head—one that will give you some service until that time. Just remember that if the difference is too great, the unit will not balance on the HP-431 power meter.

Now, what follows is not a Hewlett-Packard thermistor selection process but rather a simple, quick, and easy-to-perform DC resistance check. The resistances of the thermistors should be quite close in relationship to each other. Nominally, I have made readings near the 3000-ohm area using a 1000-ohm-per-volt VOM, a Radio Shack $10 special. The specific resistance is not important—just that the thermistors are in the range and close to each other. What is critical is the match between the two thermistors.

I have observed some power head thermistors read 2.758 ohms and 2.786 ohms, 1320 ohms and 1285 ohms, 3.956 ohms and 3.984 ohms. Others I have tested all showed being in the vicinity of each other (let's say to less than 5% or so). If this match is

quite close, the head should work. Out of 25 or so heads verified in this manner, only two showed problems. One was temperamental in that it showed instabilities like a microphonic connection, and the other one was 5 dB off in calibration and not linear. The other units evaluated out of a batch of some 75 heads considered over many years were not suitable for further evaluation. Most had one thermistor open or the match was quite bad.

Examples of bad thermistor heads

A bad or defective thermistor head is one that has one thermistor open, usually the RF detection thermistor. In an HP-478A mount the maximum RF power to be detected is 10 mW. I usually suspect that 10 *watts* or some excessive power above 10 mW caused the thermistor to go up in smoke ... Usually the RF head will handle an over-range input of +20 mW for a short time, but you are "tickling the tail of a dragon" if you try.

Over-range input power also has caused matched thermistors to heat up excessively and change their resistance values, rendering a previously matched set of thermistors unmatched due to excessive RF heating. The result is a head that will not zero-calibrate and is considered smoked just as much as one that is open for all practical purposes. When this happens, you will not be able to balance the meter, rendering the RF head useless.

Checking the thermistor heads in this case, you might obtain DC resistance readings that vary according to the type of meter you use. Just be sure that the two thermistors are somewhat close to each other and you should be OK. 200 ohms imbalance should be OK, but as it gets higher, suspect trouble. If the price is low, give it a try. If the price is quite high, I would avoid heads that are over the 200-ohm range unless you can test them on a workbench or get a return guarantee. The resistance must be less than 200 ohms difference to be able to bring the HP-431 power meter to balance. 100 ohms on the HP-432 proved to be OK, but I could not find any over 200 ohms to test on my bench meters to confirm my resistance speculation.

The pinout is the same for many different manufacturers besides Hewlett-Packard that also make the 431-type power meters. I suspect most are authorized duplications made under contract to HP but carry other designations and are physically identical to the HP-478A thermistor heads. Most were manufactured by Struthers and other manufacturers. Recently I picked up an 18 GHz waveguide head that was manufactured by PRD. It was strikingly similar to the HP types. Even the connector seemed identical, so I tried the old POVM meter I carried in the car glovebox and put it to a test. Out of three tested, only one proved to be any good in matched thermistors.

Two other units tested with both thermistors showing continuity, but their resistance readings seemed at the edge of my tolerances. I talked the surplus store into letting me take the two heads on credit, to be returned that day, if a home test proved them not compatible with the HP meter system. Well, I am happy to report that the one PRD head that tested within close tolerance balanced and reads quite accurately. The other two heads that seemed to be at the edge of my tolerances would not balance and were returned to the surplus store. Did not want to make a costly mistake again.

Terminations and RF attenuators

The other components needed to make good power measurements into the microwave region are a good set of various attenuator values. Usually a set includes 3, 6, 10, 20, and 30 dB two-watt attenuators or, as more commonly called, pads. Two things are important in selecting or paying a price for a pad. Pads are rated in frequency and attenuation. If you intend to use a pad at 10 GHz, make sure that it is rated for operation at this frequency.

Usually, the attenuation and frequency characteristics are printed on most pads. If it is not, you are on your own as far as frequency is concerned. I have had some very high quality pads that looked top of the line, but as far as performance was concerned, they became screwball and nonlinear as to attenuation when the frequency increased beyond 6 GHz.

At 10 GHz, this particular pad exhibited some 35 dB of loss; at 8 GHz, loss was 32.4 dB; and at 6 GHz, it measured 30 dB. Decreasing frequency, the 30 dB loss maintained stable. This showed that this pad was not designed for operation at all above 6 GHz. By the way, it did not have any frequency marking or rating on it. I have tested HP pads that are rated to 12.4 GHz; they are quite good even far above their 12.4 GHz frequency limits.

The other rating that is important is the loss value of the pad. Here we can make some determination just if the pad is OK. Enter the handy VOM again. An attenuator or pad is usually constructed in a "T" fashion, giving equal resistance to both the input and output coaxial connectors with respect to ground. Usual construction comes in the form of a small cylindrical input and output resistor forming the center conductor of the "T" pad. The shunt or center resistance to ground is a very large diameter resistor connected at its center to the two input/output resistors. Being circular in design, its outer edges are connected to

Number 42 on your Feedback card

Carr's Corner

Joseph J. Carr K4IPV
P.O. Box 1099
Falls Church VA 22041-0099
[carrjj@aol.com]

Hybrid couplers are an interesting class of devices. The most interesting property is that they will split an input power two ways. Each of these outputs receives -3 dB of the input power (i.e., a two-way split). Some hybrids produce in-phase outputs, others (called "quadrature" hybrids) produce 90-degree outputs, and others produce 180-degree (out of phase) outputs. There are a number of devices that are useful, but among those that I find most interesting are the Magic-T devices. In this month's column we will take a look at the fascinating Magic-T. The Magic-T produces 180-degree out of phase outputs.

The Magic-T transformer

Fig. 1 shows the Magic-T transformer hybrid. It consists of one center-tapped winding and one non-tapped winding. Which of those windings will be used as the input or output depends on the application. The relationship of the impedances is shown in **Fig. 1**. The system impedance, R_o, appears at the ends of the center-tapped winding (Port-2 and Port-3), while the impedance at the tap (Port-4) is $R_o/2$. The impedance at the ungrounded end of the non-tapped winding (Port-1) is $2R_o$.

Let's take a look at two situations. First, a signal is applied to Port-1. If Ports 2 and 3 are properly terminated in the system impedance, then the power will split 3 dB to each port, but the voltage appearing at the two ports is 180° out of phase. Port-3 is thus 180° with respect to Port-2. Both Port-2 and Port-3 are -3 dB with respect to the input level. Because Port-4 is the common between ports 2 and 3, the voltage is zero, so Port-4 is the isolated port.

The next case would be a signal applied to Port-4. This signal is split two ways, -3 dB each to Port-2 and Port-3. The signal at Port-1 will be zero because equal but opposite currents from Port-1/Port-2 and Port-1/Port-3 are induced into the untapped winding, thus canceling each other.

Practical 50-ohm example

The combiner/splitter shown in **Fig. 2** is designed to 50-ohm systems, so the tap is terminated in a 25-ohm noninductive resistor. The input is the non-tapped winding. In order to reduce the 100-ohm impedance that one would expect from the previous case, where the turns ratio is 1:1, the turns ratio is adjusted to 1.414:1, although in practice a 1.5:1 ratio is normally used. This transforms the impedance to close to 50 ohms.

Transformer matched Magic-T

A different approach to input impedance transformation is shown in **Fig. 3**. The circuit is otherwise similar to the previous circuit, except that the transformer turns ratio is the same as the straight Magic-T, i.e., 1:1. A second transformer, T2, is used to transform the 100 ohm impedance reflected from the tapped winding to 50 ohms. Transformer T2 is an *autotransformer*, a transformer made with a single tapped winding rather than two windings. The tap is placed at the two-thirds point from ground.

Construction

The Magic-T can be built for any power level using appropriate toroidal ferrite or powdered iron cores for transformer T1. For receive-only Magic-Ts you can use cores such as the T-50-2 and T-50-6 in the 1 to 30 MHz high frequency (HF) region, or T-50-15 in the 100 kHz to 15 MHz medium wave region. For receiver applications use #24 AWG or #26 AWG enameled wire.

For QRP transmitters, you can use a core of the same material (the "dash number" in the type numbers above), but you should increase the size to something between the 100 (1-inch) and 240 (2.4-inch) sizes. Use wire of #22 AWG to #18 AWG, or larger if power levels are more than a few watts.

If you build one for transmitting at higher power, then you will need to use one of the larger hybrids commonly found on high power balun transformers. Also, scale the wire size up according to the power level used.

One of the applications of this type of coupler is to combine the signals from two antennas. Although any type of antenna can be used, let's consider the case of the quarter-wavelength vertical spaced a half-wavelength apart. These can be fed either in-phase or 180 degrees out of phase, depending on the direction that you want to squirt signal. A high power Magic-T and some switching can be used for feeding the antenna.

Why? One fellow told me that he would simply use a half-wavelength extra of coax to the 180-degree antenna, and that would take care of the phase shift. Yes, it would, but it also distorts the pattern. Loss in the coaxial cable means that the two

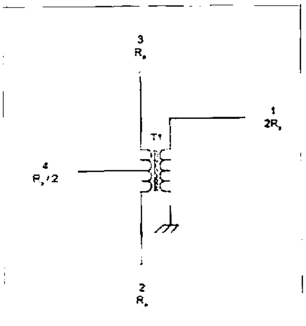


Fig. 1. Magic-T transformer hybrid.

antennas will receive different currents, and that messes up the radiation pattern. By using the Magic-T device you can use equal lengths of identical coaxial cable to the two antennas. If you want to feed them in-phase, then don't use the Magic-T. But if you want to feed them out of phase connect the Magic-T into the circuit such that Port-2 and Port-3 go to the two antennas, and Port-1 goes to the transmitter.

Other matters ...

Several readers over the past year have asked me about the availability of small parts. Too many distributors require a high minimum order or won't deal with amateurs at all. The list below is compiled from the information I have available of outfits that sell small quantities of small parts at reasonable prices. Contact me if you know of others.

Parts suppliers

Small Wonder
Dave Benson NN1G

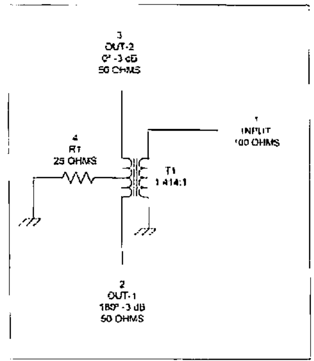


Fig. 2. Combiner/splitter.

ground and it acts as a shield between the input and output of the pad.

Well, I hope I have given you some good information with which to evaluate power meters and power meter heads. Good hunting at your next swap meet! 73, Chuck WB6IGP.

Number 43 on your Feedback card

HAM TO HAM

Your Input Welcome Here

Dave Miller NZ9E
7462 Lawler Avenue
Niles IL 60714-3108
[dmiller14@juno.com]

High-tech cleanup

Here's a handy little gadget that I ran across recently at the hardware store. It's called a PrepPen®, and it's made by Pro Motor Car Products of Clearwater, Florida. The intention of the manufacturer is that the PrepPen be primarily used for fine-detail standing, such as those hard-to-get-at contours in fancy millwork, or the small recesses in metal castings that are otherwise inaccessible to normal sandpaper and other grit-based materials.

In fact, Pro Motor Car Products bills its PrepPen as "The High-Tech Sanding Tool." While cleaning wire ends prior to soldering is mentioned on the package, I've found that the PrepPen can be used for all manner of electronic cleaning jobs around the shop. In addition to sprucing up highly corroded wire ends, it's also handy for burnishing terminal connections, PC board solder pads, corroded portable-equipment battery contacts, soldering-iron tips, and anything else that needs fine touch-up cleaning prior to use. While the PrepPen will remove some of the softer enamel-wire finishes, it won't work (by itself) on Formvar® and others that are extremely tough. They'll still need to scraped. It can, however, be used for the final, just-before-tinning, cleanup.

Physically, the PrepPen is about the diameter of a husky marking pen, which makes it easy to handle and control. Its plastic pen-shaped body houses a bundle of 20,000 very fine strands of glass fibers (each finer than a human hair), attached to a screw-thread feeder cartridge. You can adjust the length of the fibers exposed from the working end of the "pen" by simply turning the adjusting post at the far end.

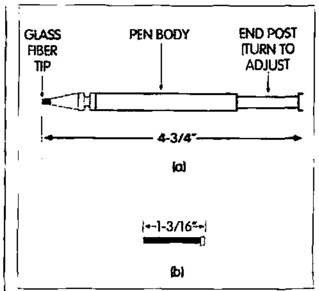


Fig. 1. The PrepPen® by Pro Motor Car Products features a replaceable glass-fiber cartridge and can be used for a number of fine-detail cleaning jobs on your ham radio workbench.

Fig. 1(a) shows the overall concept of the PrepPen, and **(b)** how the glass-fiber replaceable cartridge (about an eighth of an inch in diameter) itself looks. Some of the other jobs that the manufacturer mentions (in addition to cleaning ends of electrical wires) are removing corrosion from plumbing parts; brushing rust from small areas of chipped paint prior to touch-up (such as on an automobile); sanding hard-to-get-at recesses prior to painting; preparing parts for gluing (it dulls a shiny finish nicely); and cleaning battery contacts.

[We recently had occasion to try to remove some silk-screening from the front of an older rig, in order to change it according

---

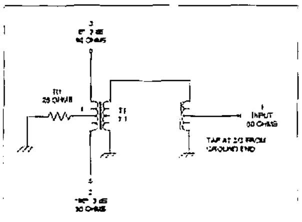


Fig. 3. A different approach.

80 East Robbins Ave.
Newington CT 06111
[bensondj@aol.com]

Dan's Small Parts and Kits
Box 3634
Missoula MT 59806-3634
Phone or FAX (406) 258-2782
[http://www.fix.net/dans.html]

Buckeye Electronics
10213 Columbus Grove Rd.
Bluffton OH 45817
[buckeye@alpha.wcoil.com]

S & S Engineering
14102 Brown Road
Smithsburg MD 21783
Phone: (301) 416-0661
FAX: (301) 416-0963

Milestone Technologies, Inc.
3140 S. Peoria St. Unit K156
Aurora CO 80014-3155
(303) 752-3382
(800) 238-8205

Kanga Products
Seaview House
Crete Road East
Folkestone CT18 7EG, England UK
Tel/FAX (44) 01303-891106
[sales@kanga.demon.co.uk]

Reading list

Another thing people ask me about is books on RF and related topics (such as antennas). I immodestly recommend a couple of my own, but the list is below. Use it for what it's worth.

1. *Introducing QRP*: Dick Pascoe GØBPS, £6.95, US$15.

2. *Pascoe's Penny Pinchers*: Dick Pascoe GØBPS, £4.95, US$8.

3. *QRP Notebook*: W1FB (ARRL).

4. *W1FB's Design Notebook*: (ARRL).

5. *W1FB's QRP Notebook*: (ARRL).

6. *Your QRP Operating Companion*: KR7L.

7. *How to Get Started in QRP*: K4TWJ.

9. *The Joy of QRP*: WØRSP.

10. *Practical Antenna Handbook, 3rd Edition*: Carr, Joseph J. McGraw-Hill, New York (1998).

11. *Microwave and Wireless Communications Technology*: Carr, Joseph J. Newnes, Boston (1997).

12. *Secrets of RF Circuit Design, 2nd Edition*: Carr, Joseph J. McGraw-Hill, New York (1996).

13. *Radio-Frequency Electronics: Circuits and Applications*: Hagen, Jon B. Cambridge Univ. Press, Cambridge, UK (1996).

14. *High Frequency Circuit Design*: Hardy, James. Reston Publishing Co. (Division of Prentice-Hall), Reston VA (1979).

15. *Standard Radio Communications Manual, with Instrumentation and Testing Techniques*: Kinley, R. Harold. Prentice-Hall, Englewood Cliffs NJ (1985).

16. *Practical Microwaves*: Laverghetta, Thomas S. Howard W. Sams, Indianapolis IN (1984).

17. *Microwave Devices & Circuits*: Liao, Samuel Y. Prentice-Hall, Englewood Cliffs NJ (1990).

18. *HF Radio Systems & Circuits, 2nd Edition*: Sabin, William E. and Schoenike, Edgar O., editors. Noble Publishing, Atlanta GA (1998).

19. *Electronic Communication, 3rd Edition*: Shrader, Robert L. McGraw-Hill, New York (1975).

20. *RF Design Guide*: Vizmuller, Peter. Artech House, Boston/London (1995).

21. All of the ARRL's books.

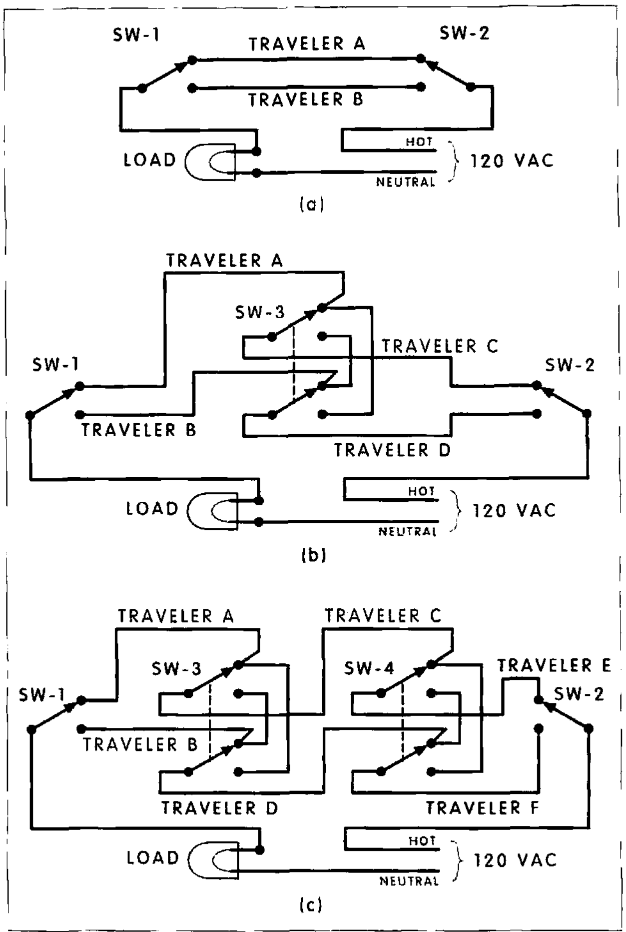


***Fig. 2.** (a) Well-known three-way switching configuration. (b) Four-way switching configuration allowing On/Off control from three distinct locations. (c) Four-way switching configuration allowing On/Off control from four, five, six or more distinct locations. Note: "Travelers" are defined as conductors between switches.*

to a mod we had done. Some sly testing showed that nothing—including rubbing compounds and soft abrasives—seemed to work without affecting and marring, however slightly, the underlying finish. Nothing, that is, until retired Grumman Corp. technician Stanley Rasanen of Nesconset NY pulled an ancient fiberglass pen out of his junkbox, hoarded since the '60s, and suggested using it as an eraser. Same idea as the PrepPen, and worked great for this.—Ed.]

The PrepPen measures four and three-quarters inches long and is about nine-sixteenths inches in diameter at its widest points. The glass-fiber cartridge is one and three-sixteenths inches long, and, of course, wears down as the tool is used, but it still should last a reasonable amount of time before needing replacement. With my PrepPen, the manufacturer had thoughtfully packaged one spare cartridge in the hollow of the rear adjusting post (the unit easily comes apart for cartridge replacement). The PrepPen is available at most automotive, hardware, and home-center stores nationwide.—de NZ9E.

Analyzing ... the problem!

From Stephen Reynolds NØPOU: A word (or several) of caution: "Using an RF antenna analyzer to determine the accuracy of the match for an HF antenna can sometimes be misleading ... especially if a strong local broadcast station is on the air in the area. Strong RF fields can throw the analyzer off because it can't distinguish between locally strong out-of-band signals and the signal that the analyzer itself is developing."

Interesting point. Stephen also mentioned that you must be very careful when connecting the coax connector onto the Autek RF Analyst®. Any twisting of the connector's center pin, during installation or removal, can break connections on the inside of the unit, necessitating time-consuming (and perhaps costly) repairs. His answer to the problem was to permanently install a UHF right-angle adapter onto the Autek's UHF fitting, and only install the coax cable connector to that right-angle adapter, thus absolutely avoiding any twisting of the instrument's built-in coax fitting during normal usage. Good tip, Stephen.

Stay in control

From Jim Kocsis WA9PYH: How to control just about anything that you'd like to turn on and off, from as many locations as you can imagine: "If you need to control a circuit from several different locations, then this may be just the thing you've been looking for! Using two SPDT switches to control a circuit from two distinctive locations is no big secret ... so-called three-way circuit switching has been used for years in the electrical trade and it's likely that you now have one or two lighting circuits in your home controlled by three-way electrical switches. **Fig. 2(a)** shows how the circuit is wired, and of course it's used to turn the same lights on or off from two different places. But what if you want to have more than two different control locations?

"Electricians use four-way switches (DPDT switches that are crosswired internally so that only four of the six terminals are brought outside) to accomplish just that task. **Fig. 2(b)** shows how it's done. SW-1 and SW-3 are SPDT three-way switches and SW-2 is a DPDT internally crosswired four-way switch. No matter what position any of the switches ends up being left in, at any of the locations, the circuit can be turned on or off from any other location.

"Now take a look at **Fig. 2(c)**. Here we see two SPDT three-way switches and two DPDT crosswired four-way switches. This combination allows us to control our circuit from any of four distinct locations, again, regardless of what position any of the switches is left in at any of the other locations. In fact, just by adding more DPDT crosswired four-way switches, you can control the circuit from as many positions as you wish (just remember that you need to end up with the SPDT four-way switches at each end of the circuit as shown).

"In addition to using this scheme to control a lighting circuit, you can use it to turn on or off anything you'd like, such as a whole-house speaker audio feed from your ham shack! Just use miniature SPDT and DPDT toggle switches, capable of handling the voltage and current of the circuit that you wish to control, and wired as shown in **Fig. 2(c)**. Of course, if you're controlling a 120 volt AC circuit, use only UL-approved three-way and four-way electrical power switches and wiring specifically manufactured for that purpose."

Why are they called three-way switches when they are installed in two different locations? Only Edison knows for sure, but the best answer is that "three-way" refers to three different modes of operation. In **Fig. 2(a)**, the lamp can be turned on and off from SW-1, on and off from SW-2, or on from one switch and off from the other—three distinct ways that the circuit can operate.

Pot luck!

From Herb Foster AD4UA: "The MFJ-418 Pocket Morse Code Tutor is a really handy

little device and truly does fit easily in just about any pocket. The earphone option is particularly nice, sparing innocent bystanders from the pain and misery of the Morse code discipline! Since I use my 418 daily to keep my CW speed up to par, it eventually developed a scratchy volume control, apparently just from plain wear. The obvious fix was to replace the control entirely; it's a 10 k pot with a switch, and is available from MFJ [(601) 323-5869 for credit card orders] for $3.48, including shipping.

"Here are a few tips to make replacing the 418's volume control a bit easier: Be sure to use care when opening the case, since there's a flat ribbon cable that connects the board to the LCD display. Try to disturb this cable as little as possible. The old pot comes out easily by using a pair of miniature side-cutters to cut the five connecting straps that connect the pot to the board. Then, a fast touch with a fine-tip iron will remove the stubs of these straps. Save the knob, as the replacement pot/switch doesn't come with one. After you've soldered the connecting straps to the new pot, just drop it in, solder down the five connections to the board, and install the old knob (it takes a micro-tipped Phillips screwdriver).

"When the nine-volt battery gets weak, you'll notice the LCD display blinking in time with the transmitted code. This is a good indication that it's time for a new battery.

"I feel that MFJ may have slipped on one small point in the design of the 418. If you like to be able to observe the LCD display as you use the Morse Tutor in your CW practice, the natural tendency is to lay it down on a desktop with the LCD display facing upward. Unfortunately, this also puts the speaker facing downward toward the desktop, and the sound becomes muffled.

"The fix to this is to buy a package of rubber bumper feet, available widely from hardware stores and supermarkets, and cut out small pieces about three-eighths of an inch square. Put these at the four corners (on the underside), where the speaker grill is located. Two of them will end up on the corners of the battery cover. Now you should be able to put your 418 on a desktop with the display upward, and hear the code audio loud and clear!

"By the way, use the MFJ-418 in the practice QSO mode, and after a few exchanges, the calling station will say that he must QRT for a variety of reasons—the most imaginative one being to change the baby! These *are* the '90s, aren't they?"

Murphy's Corollary: A "fail-safe" circuit will usually destroy the circuit it's protecting!

As always, our thanks go out to those who've contributed their ideas to this month's column, including:

Stephen Reynolds NØPOU
510 S. 130th St.
Omaha NE 68154

Jim Kocsis WA9PYH
53180 Flicker Ln.
South Bend IN 46637

Herbert L. Foster AD4UA
3020 Pennsylvania St.
Melbourne FL 32904-9063

If you're missing any past columns, you can probably find them at *73*'s "Ham To Ham" column home page (with special thanks to Mark Bohnhoff WB9UOM), on the World Wide Web, at: [http://www.rrsta.com/hth].

Note: The ideas and suggestions contributed to this column by its readers have not necessarily been tested by the column's moderator nor by the staff of *73 Magazine*, and thus no guarantee of operational success is implied. Always use your own best judgment before modifying any electronic item from the original equipment manufacturer's specifications. No responsibility is implied by the moderator or *73 Magazine* for any equipment damage or malfunction resulting from information supplied in this column.

Please send any ideas that you would like to see included in this column to the address at top. We will make every attempt to respond to all legitimate ideas in a timely manner, but please send any specific questions, on any particular tip, to the originator of the idea, not to this column's moderator nor to *73 Magazine*.

HAMSATS

Amateur Radio Via Satellites

Andy MacAllister W5ACM
14714 Knights Way Drive
Houston TX 77083

If you're waiting expectantly for the launch of Phase 3D, don't. Once a launch opportunity is announced, it will still be a while before the actual event. But, with the addition of two new digital satellites, *TMSAT-OSCAR-31* and *Gurwin-OSCAR-32* (*Techsat-1B*), and more hamsats on the way, there are plenty of exciting opportunities coming soon.

TMSAT-1 (*T-O-31*) from Thailand and the University of Surrey should be ready for general use by the time you read this. Although there is some concern about the transmitter output level on 436.923 MHz dropping from 1.8 W to 0.9 W, the other onboard systems are working very well. Many excellent pictures have been taken by the satellite and can be downloaded directly from the satellite or viewed via the Internet on the AMSAT Web page at [http://www.amsat.org]. Just look for the links to TMSAT. The direct URL (Universal Resource Locator) to TMSAT is: [http://www.ee.surrey.ac.uk/EE/CSER/UOSAT/amateur/tmsat/].

Although *T-O-31* is capable of running 9600 baud, it is expected that 38.4 kbps (kilobits per second) will become a standard downlink speed due to the large size (3.3 Mb) of the Earth-imaging pictures the satellite is producing. The compressed images available via the Internet are over 500 K each, JPEG format, so there is some minor image quality loss. For the multi-spectral images, data from the Narrow Angle Camera, sensing in the green, red, and near-IR spectra, is processed to create an image 1020 x 1020 pixels, covering an area of 100 x 100 km at a mean ground resolution of 98 meters/pixel. The *T-O-31* picture of San Francisco shows excellent detail with many easily recognizable areas.

Information has been a bit slow about activities surrounding the new Israeli hamsat *Gurwin-OSCAR-32*. The primary downlink has been on 435.225 MHz (9600 baud), but the satellite can also transmit on 435.325 MHz. During the testing phase, a three-second burst of data could be heard once every 30 seconds, but while the satellite is in normal operation, signals can be continuous, especially during picture downloads. *G-O-32* has already taken several pictures from space. Like the ones taken by *T-O-31*, the Techsat images can be found on the Internet. To find out the latest information and look for Earth-imaging pictures, check the URL: [http://techsat.internet-zahev.net/].

New signals from space

There's more on the way! The *SEDSAT-1* satellite project has been moving slowly forward for nearly a decade, and launch is imminent. Another exciting

Photo A. TMSAT-OSCAR-31 *took this shot of the San Francisco Bay area.*

program is ARISS (Amateur Radio on the International Space Station).

SEDSAT-1

SEDS stands for Small Expendable Deployer System. A 20-km tether is used to deploy a small satellite out to a higher orbit from a larger mass while both are connected together via a cord or tether. The satellite, *SEDSAT-1*, has three basic payloads, including SEASIS (SEDS, Earth, Atmosphere and Space Imaging System), TAS (Three-Axis Acceleration Measurement System), and the ham-radio payload.

SEASIS will provide some scientific experiments and allow for unique pictures from space. The CCD-camera systems use a telephoto lens and also a PAL (Panoramic Angular Lens) that will provide 360-degree pictures.

The TAS unit is part of the data collection system to study the dynamics of a mass (the satellite) deployed with a tether. After the initial tether experiments are complete, the amateur-radio payload will be available for use.

The ham radio, analog Mode-A transponder has an uplink passband from 145.915 to 145.975 MHz coupled to a downlink from 29.350 to 29.410 MHz. It's the first American-made, Mode-A linear transponder in many years.

The digital communications system uses a 1268.213 MHz uplink with a 70-cm downlink on 437.907 MHz. It is capable of 9600 baud like the current high-speed digital satellites. Other experimental digital modes and higher speeds can be supported. Check the SEDSAT Web page at [http://www. seds.org/sedsat/] and the AMSAT Web page at: [http://www.amsat.org].

ARISS

Manned-space ham activities will experience a quantum leap with the full implementation of ARISS, or Amateur Radio on the International Space Station. While the advances of voice and packet operations on *MIR* have proved to be incredibly valuable for educational and recreational activities, they will be viewed as only a step on the path to a rather significant, full-featured ham station in orbit, in just a few years.

While a very simple amateur-radio payload was proposed for Owen Garriott's *Skylab* mission in 1973, it would be 10 years later when Owen finally got to operate from space. NASA did not approve the *Skylab* ham station due to time constraints and other factors, but SAREX, the Shuttle Amateur Radio Experiment, was delivered to orbit with *STS-9* on November 28, 1983. The small Motorola two-meter HT and window-mounted antenna systems have done extremely well for over a decade and have been enhanced with SSTV (Slow-Scan Television), packet, and FSTV (Fast-Scan Television) gear. As NASA Principal Investigator until his retirement just a few years ago, Lou McFadin W5DID supported the effort from its inception. Since then, Matt Bordelon KC5BTL has taken over to provide continuity for the program.

AMSAT Vice President of Manned Space Activities Frank Bauer KA3HDO is the designer

Photo C. SEDSAT-1 *is under construction in Huntsville, Alabama.*

Photo B. This view of Earth was taken from Gurwin-OSCAR-32.

Photo D. ARISS Coordinator and AMSAT VP Manned Space Activities Frank Bauer KA3HDO shows off the inside of an ISS module mockup.

Number 47 on your Feedback card

On the Go

Mobile, Portable and Emergency Operation

Steve Nowak KE8YN/4
1011 Peacock Ave. NE
Palm Bay FL 32907-1371
[ke8yn@juno.com]

Up, up, and away

Part of the fun of operating mobile or portable is the actual operation, while an equal part is the location or conditions under which you operate. Not every mobile operation is in a car, and some vehicles are more challenging than others. Although we are licensed to operate our transmitting equipment, sometimes that alone is not sufficient to permit the operation of a transmitter. In some operating positions there are others who can dictate as to whether or not a station may be operated. Two classic cases are on board a boat or ship and aboard an aircraft. Both situations are similar because the master of the vessel, whether a ship's captain or the pilot in command of an aircraft, must give permission before someone may operate a station on board.

Operating aeronautical mobile can be a lot of fun, but a number of factors must be considered. First, it cannot be done on a commercial scheduled flight, since all airlines not only prohibit the operation of transmitters by passengers, but also the operation of radio receivers. This is because there are concerns that electronic equipment may interfere with the aircraft's electronic equipment, which provides both communications and navigation support. Virtually all commercial flights are operated in controlled airspace under instrument flight rules which require frequent communication with air traffic control. Transmissions which occur within the skin of the aircraft may create interference to the navigation equipment. There are even concerns that receivers can cause interference because of the intermediate frequencies which they produce. Given some of the interference we hams have seen with consumer electronics, this is not an idle concern. How many times have you heard of RFI problems with electric organs, inexpensive telephones, or even doorbells?

On some aircraft, radio operation may be possible. "Aircraft" may mean a hot air balloon, a glider or sailplane, a blimp, or a private plane. While radio operation may be possible on a helicopter, most helicopters produce enough noise to make it impractical.

Of all of the options, the one you may have the greatest opportunity to try is on a private plane. Once again, remember this is subject to the approval of the pilot in command. Courtesy and curiosity should dictate being aware of the pilot's radio equipment before considering the addition of amateur communications. Navigation is generally between 108 and 118 MHz. Communications among aircraft or between aircraft and the ground are generally conducted between 118 to 137 MHz. These frequencies use amplitude modulation, which is not as commonly used as either FM or single sideband. I've read various articles which state that this is because there is too much old equipment to convert to FM, but there is also another explanation which may be more accurate. FM receivers capture the stronger of two signals, whereas AM allows two signals to both be heard to some degree. With AM, if an aircraft were to make an emergency call while another aircraft were transmitting, the emergency call could be heard. Some aircraft may have other navigational receivers for nondirectional radio beacons (NDB) or for the global positioning satellite system. Interestingly, aircraft are not required to have radio equipment if not flown in an area which is under air traffic control, although most do have several radios, often backed up by an aviation band handie-talkie.

An aircraft with radio equipment operating in most areas will be in communication with some form of air traffic control. This may be a tower of a center. If no traffic control is available, a common frequency will be used as a unicom or common traffic advisory frequency for a particular airfield. Many aircraft will use a second radio to monitor the emergency frequency of 121.5 MHz, which is used both to request assistance and by emergency locator beacons.

Naturally, operating as an aeronautical mobile amateur radio station will have certain restrictions based on room for a rig and an antenna. While external antennas can be configured from many frequencies, the antenna creates drag on the aircraft, which may affect its performance. A vertical antenna

Continued on page 50

---

and chief organizer of ARISS. His three-stage plan to make a permanent place for ham radio on the International Space Station has required many hours of dedicated effort.

The first stage of Frank's plan calls for two-meter and 70-cm FM capability with an external antenna. In addition to voice, an automatic packet BBS (bulletin-board system) would be included. The radios would be intrinsically-safe commercial HTs from Ericsson. They are simple to operate, include screen displays for frequency and other data, and can be easily reprogrammed in orbit via the laptop computers carried on the ISS. The TNC, or Terminal Node Controller, for packet operation is to be a PicoPacket unit from PacComm. It should function in a very similar fashion to the unit currently on *MIR*.

The second stage of the project, in about five years, is to arrange for space on an Express Pallet. This is an externally mounted experiment container that can be loaded with ham gear that can emulate a ham-radio satellite and attached to the ISS. The contents are not brought aboard the station, but are powered from the ISS and can be controlled from the station or from the ground. A repeater or OSCARlike linear transponder system could be built into the container, complete with external antennas.

The third and final currently-planned stage of the ARISS program includes ham gear in permanent rack space in the habitation module of the space station. The proposal has been approved and the gear is in development.

Goals for the system include voice, packet, satellite and ATV (Amateur TeleVision) concurrent operation. Based on the goals, the envisioned hardware would require 24 inches of rack space and would draw 200 watts. Multiple transceivers would be used to cover 10 meters, two meters, 70 cm, 23 cm and higher bands. Power output will be five to 25 watts except on ATV, where 100 watts is more appropriate. External omni antennas would be incorporated except for gain antennas for satellite and high-data-rate digital communications.

The ARISS program is progressing very well with partners from many countries. You can study the details for yourself via the Internet. Start at the URL [http://garc.gsfc.nasa.gov/~ariss/].

Number 48 on your Feedback card

NEW PRODUCTS

3 El 6 m Yagi from MFJ

A directional antenna is essential for long-distance VHF communication. By focusing transmitter power onto the horizon in a single direction, MFJ's three-element six-meter yagi, the new MFJ-1762, *quadruples* effective radiated power over a half-wave dipole.

At the same time, the sensitivity toward the front of the antenna is greatly improved, while unwanted noise and interference are minimized.

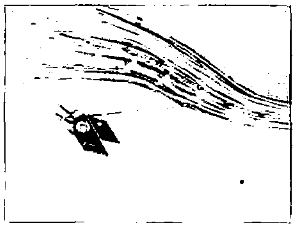
Two MFJ-1762s can be stacked to double the transmitter ERP and the received signal over a single antenna. Stacked antennas have greater capture area, which can improve reception even more.

The MFJ-1762 is an excellent choice for six-meter portable or rover operation because of its compact size (six-foot boom), light weight (two pounds), and easily removed elements. It's bargain-priced at $69.95—and of course it's covered by MFJ's *No Matter What*™ one-year unconditional warranty. See your dealer or call (800) 647-1800 to order. You can FAX (601) 323-6551; or write to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville MS 39759.

We Could Show You the Photo ...

... but then we'd have to kill you. You know, those covert-action agency guys take these antennas very seriously. So can you—antennas designed for the FBI, US Marshalls, DEA, et al., are now available on ham, SWL, and scanner frequencies!

If you need stealth antennas for HF, VHF, or UHF, or if you need high-performance, low-cost invisible antennas, you should be browsing through Hamco's new catalog of covert antennas. It's packed with information about hidden antennas, and all you need to get one is $2.00 for shipping & handling. Send the two bucks to: FEICK, Ste. I239193, 3590 Roundbottom Road, Cincinnati OH 45244-3026, and request the *Hidden Antennas* catalog. You don't even have to give a password.



Snip, Snap

When did you last replace your wire cutters? Wouldn't it be nice to make effortless flush cuts on copper, annealed steel, and alloyed wires—clean, square cuts? You bet. So check out Xuron Corporation's LX Series Micro-Shear® flush cutters. They nestle comfortably in your hand and the patented Light Touch™ return spring needs just that. Millions of beautiful cuts for $13.00—or $14.00, if you go for the tapered LXT version, or the LXF, with its factory-installed lead retainer to prevent flying leads. For more information, contact Xuron Corporation, 60 Industrial Park Road, Saco ME 04072; call (207) 283-1401; FAX (207) 283-0594; or look around where you buy better tools.

Code Practice for Your Commute

Buckmaster's *Copy This and Pass*™ audio CD collection will give you something to do besides cuss at the Dodge that just cut you off—or you can listen and learn in the (less stressful) comfort of your home (or office, or the park, or the beach ... well, you get the idea). The 5 wpm disc teaches the code with left-channel voice assist. The 13 wpm and 20 wpm discs build proficiency and skill in higher-speed operation.

Each CD is 74 minutes of near-perfect computer-generated, DSP-filtered International Morse code audio practice. You'll learn letters, numbers, punctuation, groups, words, and prosigns. Printed answer keys are included with each CD, so you can check the ones you weren't sure about, and you can vary the practice selection with the random or mix feature on your CD player.

Each *Copy This and Pass* audio CD is $10.00, or get all three for $25.00 (plus $5.00 s&h per order). Call (800) 282-5628 and use your Mastercard, Visa, or Discover card, or send check or MO to Buckmaster, 6196 Jefferson Highway, Mineral VA 23117.

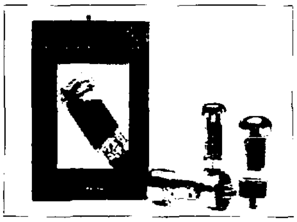
Keys of the (United) Kingdom

Gordon Crowhurst G4ZPY, as *aficionados* are aware, has long been hand-crafting premium-quality keys and paddles. The straight keys range from simple brass keys on stone bases to the Sovereign presentation key, with engraved plaque, British gold half-sovereign inlaid in the top of the knob, and a glass cabinet with gold-plated edging.

Paddles range from the postage stamp-sized three-in-one to the Very High Speed Paddle (rated at 60 wpm), available in solid gold with jewels. Each key is assembled by hand and adjusted personally by G4ZPY before shipment to the US.

How can I get one? you ask excitedly. Well, through your source for all things Morse, of course! Credit card orders can be placed by calling Morse Express at (800) 238-8205; or you can use the secure order page at the Morse Express Web site: [http://www.MorseX.com].

To request a catalog or for more information about the G4ZPY keys, call Marshall Emm at (303) 752-3382; E-mail him at [info@MorseX.com]; or write to Morse Express, 3140 Peoria St., Unit K-156, Aurora CO 80014-3155.



Better Late than New Year

Svetlana Electron Devices, Inc., of St. Petersburg, Russia, has released its *1998 Audio Tube Catalog*. Svetlana has been manufacturing vacuum tubes since 1928, and is one of the largest international suppliers of audio tubes to OEMs. Svetlana's extensive variety of audio tubes are designed and built with exceptional quality and sonic performance characteristics. Catalogs are built with bureaucratic performance characteristics. Never mind. Get a 1998 one anyway, from Svetlana Electron Devices, Inc., 3000 Alpine Road, Portola Valley CA 94028; check the Web site at [www.svetlana.com].

Number 50 on your Feedback card

The Digital Port

Jack Heller KB7NO
P.O. Box 1792
712 Highland Street
Carson City NV 89703
[jheller@sierra.net]

You may have read or heard comments about the state of amateur radio and how we need to get off our duffs and get back to cutting-edge technology. That is, we need to get beyond the world of rag-chewing on repeaters and SSB. There are commercial outfits out there who are willing to push hams right off the spectrum map so they can purchase, utilize and make bucks using the frequencies we take for granted.

Additionally, these capitalists justify their right to purchase "our air space" by taking the position that ham radio has ceased to contribute to the development of the art of communication and is merely following its lead. If that isn't enough, many local government emergency coordinators are not sold on the value of ham radio in an emergency and choose to rely on their own sophisticated systems.

While pondering these viewpoints, I reviewed a recent letter from Bob W6EUZ concerning his experiences with SSTV. He wrote because he had read of some of my experiences and felt he could help me "get a grip" (my phrase—not Bob's) on reality about HF SSTV in the western states.

Bob was not having the instant success I had promised and expressed some needs for possible organization of 40- and 80-meter SSTV activity out west. The more I thought about this, the more sense it made. Experience had taught that it is difficult at best to work the folks in the east on 14.230 without an amplifier. (At this writing, I am still without the amplifier that smoked during a recent RTTY session.)

As the above two facts chewed on my senses for a few days, it became obvious that something more in-depth than the return letter to Bob was justified. He hadn't left his phone number, so I started tracking it down. This was a little comical. My first attempt was to look in the Internet "white pages" listings.

There was one listing that almost fit Bob's description, and I called hoping it was a relative. No, there are just a lot of listings with the same first and last name. But I had the area code now. Still, it would seem that one of the on-line databases should come through. I was beginning to think he was unlisted.

One more try. Dialed information on the old-fashioned landline and ... Bingo! I had a number. The lesson? Those databases on the Net are not complete. Enough of that. I could have saved 45 minutes, but you know the male ego when it comes to stopping to ask for directions.

Bob had some interesting input. He, like most of us, attempts to be a frugal ham. SSTV *can* be done on a budget, as I have demonstrated, but things go wrong. He told me of a nifty new unit by Kenwood that I had not heard about. I looked up a description of it. It appears to be a digital camera that not only interfaces to the computer but also to Kenwood radios. It is model VC-H1.

That sounds very innovative and should be an ideal setup. He says it works great interfaced to his Kenwood HT for VHF as well as to his Kenwood HF rig, but that the company is still working out the details (cables) to work with other rigs. I found the scant details listed on the Kenwood Web site, but Bob's info filled in the chinks. The little camera should be a great addition to anyone's array of Kenwood gear and other lines as cables are made available.

Bob and I arranged to meet on 40 meters the next day to see what conditions were like. They sounded good, so we made an attempt on the next weekday morning to try a little SSTV operation. It looked good at about 7.165 and I sent him an image which was recognizable on his screen—far from first rate but, nevertheless, a workable image.

This was without the help of an amplifier or any fancy antenna at either end. What was surprising to me was that there was something close to that frequency that was cutting up Bob's SSB signal badly, yet the audio carrying the image still worked. At least we came away assured that low power was not

Continued on page 51

On The Go

continued from page 47

will be limited to VHF or UHF frequencies, while an HF antenna would create a greater challenge. It is possible to run a wire from the tail of the plane to the fuselage, or to trail a wire, but these are not practical for most applications. Fortunately, a handie-talkie with a rubber duck can produce some interesting results, so we'll stick to UHF or VHF frequencies.

VHF transmissions are limited to line of sight, which is one of the reasons that effective radiated power (ERP) is a function of output power and the height of the antenna. A few milliwatts can be quite effective at 7500 feet above ground level. This is one of the reasons that it is considered very bad form to ever use a repeater from an aeronautical mobile unless it is an emergency. An HT in an airplane can bring up every repeater on a given frequency for hundreds of miles, which is not appreciated by the other users of those repeaters. Incidentally, this is another reason that cellular telephones are not permitted to be used on aircraft. Since each cellular phone is low power, the expectation is that it will reach only a few cell towers and the computer can pick the strongest signal; from an aircraft the cellular telephone would simultaneously affect many cells over a wide area, creating problems for the network.

Simplex frequencies are the way to go for aeronautical mobile operations, although a few more caveats are in order. First, never forget that the pilot is in full command. If things get busy in the cockpit and he or she tells you to cease transmission, you must comply. Second, remember that some simplex frequencies have designated purposes. The standard two-meter calling frequency of 146.52 is also used as the wilderness protocol frequency, with priority the first five minutes past the hour from 7:00 a.m. until 10:05 p.m. This is why it may be interesting to take an HT along on a private plane even if you do not expect to transmit. If the pilot in command allows you to at least monitor, you may be surprised by what you hear from that altitude. Besides, one more working radio is good insurance in any cockpit.

What's the most interesting place you operated a station, either mobile or portable? What's the most interesting thing that has happened to you when operating? What would you like to do, do again, or do different? Let me know, either by E-mail or snail-mail to the address at the top of the column. I hear a lot of mobile and portable stations out there. Why not share your experience?

a hindrance to working slow scan on 40 meters.

What is needed is a clear frequency at the right time of day. In the eastern part of the country, the recommended frequency is 7.171. However, neither of us had heard a 40-meter slow scan signal from this end of the country and there is an apparent broadcast signal close by.

We decided to meet as often as we could in the early part of the afternoon at 7.190, as that sounded like it had the least interference. Bob was in a transition between rigs and I had to be out of town, so it was a week or so before we got our schedule together.

Incidentally, there is SSTV activity on 3.785. I ran across it one evening. An attempt to copy failed due to the splatter from an adjacent (about 3 kHz away) ham engaged in ensuring he could be heard in the next county. Been that way ever since I can recall on 75 meters. There must be some simple justification for the California Kilowatt, but I have never heard it.

What does this mean for 40-meter SSTV in the west? If you are like many of us who feel it shouldn't take a megabuck/-watt station to play with SSTV, listen around 7.190 at approximately 1 to 1:30 p.m. Pacific time. If you come by when there is no activity, give a call. There may be someone just like you listening for an organized net. A net it is not. It is just a place to meet to try out some of this fun stuff and exchange ideas.

As I was talking to Bob, several ideas came to mind. The first was establishing a place and time to play. Another was the fact that most folks who would like to get involved don't know where to start and soon discover a lot of the advice falls short or just plain misses the mark.

Don't let it get confusing

Many of today's digital modes require a relatively small investment, especially when compared with a few years back when the approach was expensive hardware. Computers have made a huge difference.

To get started in SSTV, I tell people that with a good computer they can get their feet wet for under $50. One method includes using free software (EZ SSTV from Pasokon) and building a serial modem as described on the Pasokon Web site (see **Table 1**) plus cables. If you approach it this way, you will have a lot of fun watching something work that you have built from scratch. This is DOS programming and it works. If you like what you see, they have upgrades for extra bucks and you can enjoy truly great performance.

There is another way that is even more painless in the pocketbook for a budget introduction to SSTV. This one uses the soundboard in your PC, with no modem to build, and no hardware except a few cables. Connect your transceiver to your PC, and you are in business. The initial outlay? The cost of the cables. I used some old audio cable with a few new plugs and got the system working for under $10! Check out ChromaPIX in **Table 1**.

There is a slight catch, but it is not really annoying. This is shareware—a lot of work went into it, and the authors deserve to be paid if the program works for you. The program is not crippled and you can use it forever without registering, but it will only run for 30 minutes at a time until you pay your dues. You will find that is enough time, if you plan your sessions wisely, to get a good feel for this excellent program and decide if it is for you.

Help for your soundcard SSTV operation

One of the problems when using a soundcard for digital conununications is that there is no way for the soundcard to automatically operate the push-to-talk (PTT) on the transceiver. When I first tested the ChromaPIX program I found that the method to initiate the transmission of an image was to manually place my rig in transmit

Continued on page 56

Current Web Addresses	
Source for:	**Web address (URL)**
HF serial modem plans + software	http://www.accessone.com/~tmayhan/index.htm
PCFlexnet communications free programs	http://d10td.afthd.th-darmstadt.de/~flexnet/index.html
Tom Sailer's info on PCFlexnet	http://www.ife.ee.ethz.ch/~sailer/pcf/
SV2AGW free Win95 programs	http://www.forthnet.gr/sv2agw/
BayCom – German site	http://www.baycom.de/
Pasokon SSTV programs & hardware	http://www.ultranet.com/~sstv/lite.html
Winpack shareware for Windows	http://www.duckles.demon.co.uk/ham/wp.htm
Baycom 1.5 and Manual.zip in English	http://www.cs.wvu.edu/~acm/gopher/Software/baycom/
Source for BayPac BP-2M	http://www.tigertronics.com/
Tucson Amateur Packet Radio—where packet started—new modes on the way	http://www.tapr.org
TNC to radio wiring help	http://prairie.lakes.com/~medcalf/ztx/wire/
ChromaPIX & W95SSTV	http://www.siliconpixels.com/
Timewave DSP & former AEA prod	http://www.timewave.com
VHF packet serial modem kit	http://www.ldgelectronics.com

Table 1. *Current Web addresses. All of the above were cut and pasted directly from the Web page to avoid the inevitable errors when copying. If you encounter a problem with a European address, the network is often at fault. Try again later.*

73 VINTAGE REVIEW

Number 52 on your Feedback card

The Drake TR Series: No Introduction Needed

...but here's the skinny on some of the best vintage equipment available today.

Bill Clarke W2BLC
764 Altamont-Voorheesville Road
Altamont NY 12009
[BillClarke@bigfoot.com]

In the early 1960s, the R.L. Drake Company introduced a very successful line of SSB ham equipment. As a result, Drake equipment became known for its high quality and high dollar value. Today, Drake equipment is again becoming popular, as vintage equipment—representing an era of ham radio's past.

Capability-wise, the Drake TR series of HF transceivers offers good stability, has excellent receivers with great selectivity, and can do better than 200 watts output. Another real positive feature is that they are supported by a company that is still in business.

The TR-3

The Drake TR-3, introduced in 1963, was Drake's first HF transceiver. It was to become the basis for the TR-4 series that followed.

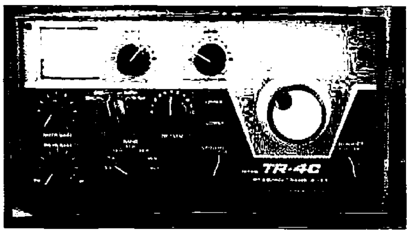


***Photo A.** The face plate, with dials in darned good shape, of the TR-4C. Photos by Joel Thurtell K8PSV.*

The TR-3 used three tubes in the final RF amplifier, as do all the TR series transceivers, unlike its contemporaries from Collins, Hallicrafters, and National.

The chassis of the TR-3 is copper-plated, although most units you will see today have some rust showing through. The front panel is labeled by reverse engraving (brushed metal that is slightly higher than the painted background). There is very little in the TR-3 that is solid state.

A new TR-3 sold for $550. Accessories were priced at: AC supply $79.95, MS-3 speaker $19.95, RV-3 remote VFO $79.95. In 1998 dollars the entire station would have cost about $3500.

Specifications for the TR-3

GENERAL
- Frequency coverage: 10–80 meters in seven 600 kHz ranges
- Modes: LSB, USB, CW, and AM
- Built-in sidetone
- Automatic T/R switching on CW
- 30 tubes and semiconductors
- VFO with 1 kHz dial divisions (on the VFO knob skirt)
- Dimensions: 5-1/2 inches high, 10-3/4 inches wide, 14-3/8 inches deep
- Weight: 16 lbs.

TRANSMIT
- Input power: SSB 300 watts PEP
- AM 260 watts PEP controlled carrier
- CW 260 watts
- Adjustable pi-network
- VOX or PTT

RECEIVE
- Sensitivity: >1/2 μV for 10 dB S/N
- IF selectivity: 2.1 kHz @ 6 dB
- 3.6 kHz @ 60 dB
- AGC (fast attack, slow release in high noise)
- RF gain control
- Noise blanker
- Diode detector for AM reception

ACCESSORIES
- MS-3 Matching speaker
- RV-3 Remote VFO (XMIT/RX or split operation)
- AC-3 Power supply (120 VAC)
- DC-3 Power supply (12 VDC)

The TR-4 series

Progressing from the TR-3 into the TR-4 series, the early TR-4 transceivers had a TR-3-style main tuning knob (kHz markings on the VFO knob

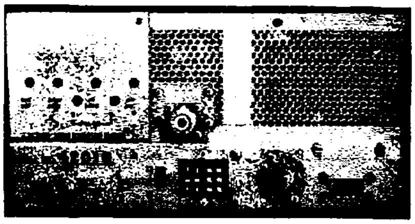


Photo B. Rear view.

skirt). The 9 MHz sideband filters used in early TR-4s are four poles and are enclosed in sealed boxes. The tubular capacitors used in the radio are white in color and were manufactured by CD. No noise blanker control is on the front panel and there are no provisions for its installation (no receptacle) on the chassis.

Late TR-4 transceivers have the TR-4C style main tuning knob (1 kHz divisions on the dial), a VFO "in use" indicator (used in conjunction with a remote VFO), and some front panel markings different in color from the early units. The 9 MHz filters have eight poles. Internally, the tubular capacitors are yellow in color and manufactured by CDE. There is a noise blanker control on the front panel and provisions for its installation on the chassis.

As with the TR-3, the TR-4 series chassis was copper-plated until the TR-4C came along. After that time, it was no longer plated.

The TR4CW/RIT was the final model in the Drake TR series. Appearance-wise, it has the RIT control positioned in the lower right-hand corner where the noise blanker control was on earlier models. Two push switches on the lower front of the panel turn the RIT and noise blanker functions on/off.

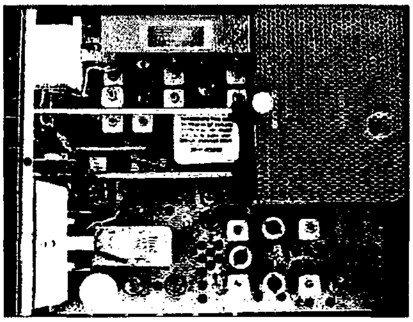


Photo C. The top view of the interior. Note the noise blanker.

By the time the series had worked its way through to the TR-4CW/RJT, the following features had been added:

•CW sidetone
•Optional noise blanker
•Receiver incremental tuning (RIT)
•Selectable 500 Hz CW filter
•Redesigned dial showing 1 kHz calibration points
•Redesigned main tuning knob
•Relative RF power output monitor
•Changed final tubes from 12JB6s to 6JB6s
•Solid state PTO (permeability-tuned oscillator)
•Fully silk-screened front panel

Overall, the TR-3 and TR-4 series of transceivers saw few major changes externally and only what amounted to upgrades internally. Also, some bells and whistles were added along the way, such as the noise blanker, optional filters, and RIT.

Drake made a 15-year run of this series before moving on to fully solid state equipment, and then slipping into obscurity in the ham radio field.

Specifications for the TR-4 ($599.95 in 1965, less power supply)

GENERAL
•All amateur bands 10–80 meters in seven 600 kHz ranges
•Solid state VFO with 1 kHz dial divisions
•Modes: LSB, USB, CW, and AM
•Built-in sidetone and automatic T/R switching on CW
•30 tubes and semiconductors
•Solid state VFO with 1 kHz dial divisions (on the VFO knob skirt)
•Dimensions: 5-1/2 inches high, 10-3/4 inches wide, 14-3/8 inches deep
•Weight: 16 lbs.

TRANSMIT
•VOX or PTT on SSB or AM
•Input power: SSB 300 watts PEP
•AM 260 watts PEP controlled carrier
•CW 260 watts
•Adjustable pi-network

RECEIVE
•Sensitivity: >1/2 µV for 10 dB S/N

•IF selectivity: 2.1 kHz @ 6 dB
•3.6 kHz @ 60 dB
•AGC full on receive modes
•Variable with RF gain control
•Fast attack, slow release with noise pulse suppression
•Diode detector for AM reception

ACCESSORIES
•MMK-3 Mobile mounting kit
•MS-4 Matching speaker
•AC-4, DC-4 Power supplies
•RV-4 Remote VFO (includes five-inch speaker) and space for AC supply
•34-NB Noise blanker

The TR-4C sold for $599.99 in 1972 (less power supply). Here's how it compared:

GENERAL
•All amateur bands 10–80 meters in seven 600 kHz ranges
•500 MHz CW filter on CW models
•Solid state VFO with 1 kHz dial divisions
•RIT (receive incremental tuning) on CW/RIT model
•Modes: LSB, USB, CW, and AM
•Built-in sidetone and automatic T/R switching on CW
•30 tubes and semiconductors
•Dimensions: 5-1/2 inches high, 10-3/4 inches wide, 14-3/8 inches deep
•Weight: 16 lbs.

TRANSMIT
•VOX or PTT on SSB or AM
•Input power: SSB 300 watts PEP
•AM 260 watts PEP controlled carrier
•CW 260 watts
•Adjustable pi-network

RECEIVE
•Sensitivity: >1/2 µV for 10 dB S/N
•IF selectivity: 2.1 kHz @ 6 dB
•3.6 kHz @ 60 dB
•AGC full on receive modes
•Variable with RF gain control
•Fast attack, slow release with noise pulse suppression
•Diode detector for AM reception

ACCESSORIES
•MMK-3 Mobile mounting kit
•MS-4 Matching speaker
•RV-4C Remote VFO
•AC-4, DC-4 Power supplies
•FF-1 Fixed frequency adapter (two fixed channels)
•34-PNB Noise blanker

Getting older

Interested in getting a vintage Drake rig? When purchasing, owning, or using any older ham gear, take note: Age will take its toll. Below is a list of several common age-related problems associated with Drake equipment:

MECHANICAL
•PTO end play needs adjustment
•PTO lubricant dried out
•Vernier drives wear, dry out, and become stiff
•Switch and control shafts dry out and become stiff
•Switch contacts wear out, corrode, or get dirty
•Dirt, dust, and rust on chassis

ELECTRONIC
•Electrolytics dry out (particularly in power supplies)
•Small parts such as resistors and ceramic caps fry
•AC line cords need replacing
•Tubes become weak with use
•Alignment is required annually
•Unknown and undocumented modifications by past owners

APPEARANCE
•Blemishes on case/face plate
•Lost or incorrect screws
•Control knobs missing, damaged, or discolored
•Front panel spacers missing
•Dial plates scraped or discolored
•Clear plastics are scratched
•Blue filters wash out

Maintenance hints

This recommendation is not just for Drake owners, or even vintage equipment owners; it applies to all of us. Start and maintain a logbook for each major piece of equipment you own (transmitters, receivers, transceivers, amplifiers, computers, etc.). A single logbook will suffice for all the small stuff, such as tuners, filters, scopes, switching systems, and anten-

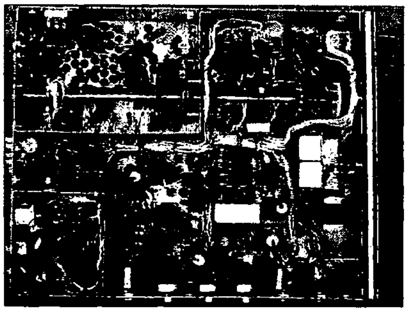


Photo D. Bottom view.

nas. Don't use a segmented logbook, as you will one day have to remove some of it (when you sell or trade a piece of equipment). A loose-leaf binder with dividers, however, would be quite appropriate.

In these logbooks, enter information about the equipment, including its history, source, past owners, price, serial numbers (for insurance purposes), date of purchase, when it was placed into service, and other comments. Every time you perform maintenance, do an alignment, make a modification, etc., make a logbook entry describing what work was done. These entries can prove invaluable as time passes—and you forget what you have done to the rig. Reverse engineering of past mods is not fun.

A complete logbook will also help a new owner in understanding the equipment and anything unusual about it (such as old modifications).

Owning a vintage Drake

A vintage piece of Drake equipment is a piece of history. It is also a rugged unit designed to be used and enjoyed. Do just that! Get it on the air and have a ball. Of course, seeing that the rig is probably 20 to 30 years old, a little care should be taken. No doubt some servicing will be necessary before you place the rig on the air, unless you got really lucky and found a top-notch one. However, at sometime in the future you will be servicing it.

Service your Drake

First and foremost—get a manual for the rig (original or copy). An "owner's" manual will normally suffice, as back when these rigs were built, most hams serviced and aligned their own equipment—hence instructions for this work were a part of the manual.

These Drake transceivers, like other equipment of the time, did not use PLLs, digital systems, electronic switching, or logic circuits. Everything was analog—very straightforward and easy to understand from a schematic diagram.

With some good common sense, the ability to read schematic diagrams and understand circuitry, and armed with a minimum of equipment and tools, most hams should be capable of maintaining this equipment.

WARNING: Unlike modern solid state ham equipment using 12 VDC, tube equipment uses voltages that can be considered lethal. Know what you are doing BEFORE you venture inside these rigs.

Hints to help

Controls (potentiometers) that sound noisy (cause crackling to be heard) should be cleaned chemically. If this does not correct the problem, the offending control will require replacement.

Switch contacts can become intermittent or nonconductive. Use chemical cleaners to correct the problem or replace the switch, switch wafer, or individual contact.

Lubrication can be made easier by using a medical-type hypodermic syringe to inject lubricant into hard to reach and tight areas.

Only use plastic or nylon tools for alignment work. They will not damage the fragile slugs.

Over the years I have found it better to replace relays than to repair them. Chemical cleaning may help; however, burnishing them is only very temporary in effect, with failure assured to happen again.

Pull each tube from its socket, check the socket, clean it and the tube's pins chemically, and reinsert the tube.

WARNING: Chemical cleaners are not friendly to the user or to the environment. Use only according to directions.

A prime cause of intermittent problems is terminal strips which are attached to the chassis with a single screw, nut and bolt, or rivet. It is a good idea to go over the entire rig and

tighten each terminal strip. If rivets are encountered, you can drill them out and replace them with nuts and bolts, when necessary.

Cases and hardware can be cleaned using automotive materials such as waxes and buffers. Front panels are another story. If there is significant damage or wear to the front panel, you may have to hire the work out. In many cases it is nearly impossible for an individual to do the work and get it to look like new.

Use hint

With all those vacuum tubes (glowbugs) packed into a relatively small cabinet. Drake transceivers make great heaters—and they get even warmer when transmitting.

I recommend you use a muffin fan over the final tubes to provide cooling. In the past, I have put rubber feet on the muffin fans and just set them on the top cover. This works and doesn't call for drilling or cutting holes in anything.

Drake company

Drake still offers factory support for their equipment, even though some rigs are over 30 years old. For more information, contact the R.L. Drake Company at (513) 746-6990, by FAX at (513) 743-4576 or by E-mail (service related only) at [bill_frost@rldrake.com]. The Drake list home page at [www.min.net/%7Ethom/drakelist/index.html] is the single best source of Drake information that I have found on the Internet. The Web page is maintained by Thom LaCosta K3HRN. Be sure to visit the section about modifications to the various Drake rigs by Wayne Montague VE3EFJ; it is very complete and extremely interesting (you could and should spend hours reading this). Thom also maintains the Drake Mailing List, which you can learn more about by sending an E-mail to [drakelist-request@baltimoremd.com] with a subject of [help]. The list-server will return a message to you with further instructions.

A special thanks to Joel Thurtell K8PSV for the photos used in this article. Joel is a specialty radio dealer and operates The Radio Finder, a Web site for the buying, trading, and selling of tube-type amateur and military radio equipment. The address of The Radio Finder is [www.radiofinder.com] or you may contact him at 11803 Priscilla, Plymouth MI 48170.

Seeing Dits & Dahs

continued from page 30

(from any starting point) most often resulted in a series of Ts and Es being displayed for 30 seconds or so, and sometimes required a "hard reset" by turning the unit off and then on again. Often it seemed that the decoder could correctly interpret characters, but could not quite figure out the breaks between words.

The decoder requires a very steady signal, so using it to receive off the air is difficult unless you are trying to copy a W1AW bulletin or something similar, consisting of perfect code with a strong signal.

But the Velleman Morse Decoder is very good at one application, and that is in evaluating hand-sent code. Since I had a straight key hooked up to my keyer, it was simply a matter of switching over to the key to determine whether I can send, by hand, Morse code that a machine can read. The answer was ... yes, with a bit of practice! I thought my fist was better than that, but it didn't take long to coordinate sending and reading so that I could adjust my sending to what must be darned near perfect spacing and speed consistency.

As a training aid for sending, the decoder has considerable potential and could be worth the $89.95 price tag.

Sources:

Velleman Components N.V.
Legen Heirweg 33, B-9890 Gavere, Belgium
+32 (0) 9 384.36.11
[www.velleman.be]

TechAmerica
P.O. Box 1981
Ft. Worth TX 76101-1981
(800) 613-7080
[www.techam.com]

The Digital Port

continued from page 51

mode, then tell the program to transmit the image.

That works perfectly well, but now you will find two circuits detailed on the ChromaPIX Web site that facilitate simultaneous automatic keying of the transceiver and transmittal of the image.

I opted to build the simpler circuit, as pictured in **Photo A,** to bring one-handed push-button operation into the shack.

So ... what are we going to do to attract youth to the ham ranks? What do kids do today that is similar to what we thought was cutting-edge when TV was black and white? (Oops, revealed my age.) All right—let's look at when I was a kid for a minute. I had put together a shortwave radio from a kit (Knight, I think—probably about $20 worth) and listened to the most fascinating signals imaginable. Ordinary people were talking to each other from all over the country and sometimes from other countries. They were having fun and I wanted to be a part of it.

Today's youth are caught up in the Internet, satellite TV, handheld games, cell phones, pagers and so many gadgets and toys that were nearly inconceivable just a few years back except for readers of "Buck Rogers" comic strips. That is quite a load of technology to compete with, and I doubt it can be done by making ham repeater access available to the masses. If that is all ham radio has to offer, we lose—big time.

Ask yourself: What holds my interest in ham radio? Why am I reading this magazine? You know the answers. There are still frontiers to explore via ham radio that simply are not available by purchasing a few toys at the local electronics discount emporium and plugging them in.

Those toys are good and useful, but they don't make the user different. He cannot express himself any differently than everyone else who made the same purchase. He can't modify and improve. There are no contests

NEVER SAY DIE

continued from page 5

student is, your best bet for learning is reading books. The trick is to find books that are both easy to read and reliable. I've made a stab at this with my *Secret Guide to Wisdom* review of around a hundred outstanding books. But I keep asking my readers and listeners to keep their minds peeled for outstanding books. And I've been keeping Barnes & Noble busy trying to get them for me.

Improving Your Memory

You can retain virtually everything you've read if you take a little time to refresh your memory. This is a secret technique that I've never seen mentioned by anyone, and it *is* simple.

This is best done with the help of someone else. Someone with patience. They're going to sit down with you and help you refresh your memory. What you do, just after you've finished reading a book, is to sit or lie down and get comfortable. Close your eyes and go through the book, from beginning to end in your mind, remembering every detail you can. Your helper will stop you every now and then, asking you where you are and what you are remembering. Then you'll continue scanning the book. When you get to the end, go back and start all over again, remembering every detail from the first scan, and adding other parts that you missed the first time through, as they come to mind. You'll find you can scan the first run through in a fraction of the time, but without skipping anything. When you are stopped you'll be able to say right where you are in the book. By the fourth scan of the book you'll take just seconds to cover every detail of the whole book.

Every couple of months you'll want to refresh your recall of the details, so scan the book again in your mind a couple of times to get back up to speed. In this way you'll be able to keep the details of hundreds of books right fresh in your mind.

Like any muscle or other function of the body, the more you use your mind, the more powerful it will get. They say we're using about 2% of our brains. I suspect that's a serious understatement. It's probably more like 0.1% of its real potential. Alas, laziness being what it is, many (most?) of us tend to avoid thinking as much as possible. And exercising, too. Thus many of us end up doddering, hunchbacked geezers who haven't thought an original thought in years.

Spirit Memories

When we are able to contact departed spirits via psychics, *Ouija*, tape recorders, near-death experiences, etc., we find that the spirits seem to still have all of the memories they had when they were alive. If our memories aren't electrically

for proficiency—only the day-to-day repetitive use. Curious people demand more.

There lies one of the great secrets. Pique a man's curiosity and soon there will be no holding him back. He will move mountains to satisfy his desire to know and do more. You know there are hams working at cutting-edge innovations for communications and we have mentioned them and their wares in this column. Take a look at the Web sites in **Table 1** for some ideas. Look closely at the TAPR Web site. We hams have a lot to offer.

If we take advantage of what is available, use it frequently, invite the young people in our lives to observe what they can do, and give a hint where it is going, we just may convey to the up-and-coming generation that there is something beyond the horizon. If these things could be introduced to school groups and Scouts, the kids just might take the ball and run. If they do, they will become the greatest asset ham radio has. It is up to us to stimulate that appetite.

Apology for missing last month's issue

I had a great project going last month, but it just wouldn't pan out. I had worked several days past deadline time with nothing to show for it and no backup plan. I was quite disturbed and embarrassed by the time I called in to the *73* office to say I wasn't making it for November.

I enjoy the feedback from this column and realize there are faithful readers. If you will accept my apology, I will attempt to not let that happen in the future. And please keep those cards and letters (E-mail responses are very appropriate) coming. You give me a lot of great ideas.

If you have questions or comments about this column, E-mail me at [jheller@sierra.net] and/or CompuServe [72130,1352]. I will gladly share what I know or find a resource for you. For now, 73, Jack KB7NO.

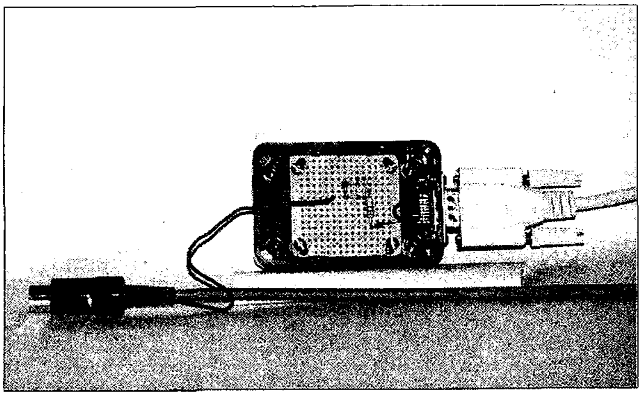


Photo A. *To add to the collection of dedicated cables and little black boxes, this is my version of the PTT circuit when using the soundcard for SSTV. The circuit is available from the ChromaPIX site. The size of the box is overkill for the few components, but it was what I had on hand and keeps it neat. The computer cable connects to the serial port. The audio cable connects the soundcard Lineout to the accessory jack on the back of the ICOM 735.*

or chemically stored in our brains, but in some other medium which we don't yet understand, that could help explain how we can have unlimited memory storage.

This isn't exactly a new idea — I wrote about this at least 30 years ago. But, you know, in spite of the many books I've read on the brain and the mind, I don't recall anyone else proposing such a controversial concept. But that might help explain why people who have lost large parts of the brains in accidents still have all of their memories.

We may be doing well with our electronic technology, but when it comes to consciousness, we're still in the Middle Ages. We know plants can communicate with each other, and with us. We know we can also communicate with any living thing, but we have few clues as to how it works. We know our cells are able to stay in instant communication with us, no matter how far removed. Again, no clue as to how.

There are still powerful barriers preventing research into this area. Barriers of disbelief, kept in place by a refusal to look at the data. Barriers of a lack of funding. After all, even if it's all true, where are the bucks to be made from funding consciousness studies?

Ice Age?

Looking at the temperature data across the northern tier states from Washington to North Dakota, temperatures since 1940 have fallen lower now than they were in 1890, when they had the Little Ice Age. This agrees with the similar decline in temperature since 1940 in every Scandinavia country, also with rising precipitation. This agrees with the declining temperatures reported by satellites and balloon radiosonde data. It also agrees with tree ring data from western and southern US and Europe, with the temperature high around 1940.

The US Dept. of Agriculture Plant Hardiness Zone Map shows a southern deflection of one zone or 10°F between their 1960 and 1990 maps. This strongly affects plants.

In New Hampshire, Vermont and upstate New York we're seeing a migration of moose coming down from Canada, so perhaps Robert Felix is right in his predictions in his book, *Not By Fire, But By Ice*. So much for global warming, eh?

American researchers at the South Pole, who have been keeping accurate records for over 40 years, reported that July 1997 was the coldest month on record.

Yes, I know about the Antarctic ice pack starting to melt and a lump the size of Connecticut calving off. So what's really going on here? Come on, fellas, you can't have it both ways. Are we going to need heavier parkas or more bathing suits and sun screen?

Child Psychology

It's been a while since I pushed you to subscribe to *The New Yorker*, so I can understand if you missed the great article in the August 17th issue about child behavior. Too bad, for it was an amazing article.

It turns out that child psychologists and behavior experts have had it wrong about the influence that parents have on the development of their children. It seems, on the nurture side, that parents have far less of an impact on their kids' behavior than do their peers. Kids don't want to be like adults, they want to be like other kids. So they dress like the other kids, talk like the other kids, and act like the other kids.

It's pertinent that the kids of recent immigrants almost never retain their parents' accents. And that the children of deaf parents learn how to speak as well as those with normal parents. It also turns out that it doesn't make anywhere near as much difference as supposed if there is one parent or two.

This goes counter to Freud and the teachings of professional psychotherapists, but is in line with the results of recent research aimed at finding correlations between parents and how their children turn out. The *Newsweek* editors apparently read *The New Yorker*, because the September 7th issue had the report as the cover feature.

Serendipity

Do you believe in reincarnation and our having past lives? My first introduction to past lives surprised me. Oh, I'd read a little about 'em, and then there was the famous Bridey Murphy case, but that, I thought, had been explained away. Then one day I was regressing a patient under hypnosis, trying to find the root of a problem that had been making his life miserable. We went back and relived several relevant earlier traumas, removing their impact on his life for him. Then I asked him to go to an earlier event which was connected to his problem and suddenly he was telling me about something which had happened in an earlier life.

I didn't know if it was real or not, so I had him relive the traumatic event just as if it were one from his present life, and he was never bothered by this problem again. Hmm. It didn't make any difference to me whether it was real as long as deconditioning the trauma did the job.

After several more patients had flipped into past lives, and more often, past traumatic deaths, the reality that these weren't just the mind's way of handling a current life painful event, but were some sort of past life memories. I began to help my patients explore and remember more of their past lives. I found that they could recall people, places, and events with a remarkable degree of detail and that these memories could be tied to historical records.

That reality took some getting used to. The ramifications took even more getting used to, and got me to questioning the accepted beliefs in Heaven, Hell, God, Satan, and so on. It got me to reading to see what other people had discovered or thought.

If you don't believe in past lives and reincarnation, it's because you haven't read very much about it. There are several books reviewed in my *Secret Guide to Wisdom* which will help fill in this neglected part of your education.

Sunday school teaches you about heaven, but the "real world" teaches that when you die, that's it, and never mind all that Bible baloney.

I've told this story before, but knowing how short your memory is, I'll repeat it. It has to do with how I discovered a book that I recommend anyone read who wants to know about death. It's a great book for comforting someone with a recent loss.

My mother had always been sensitive to things. Using a *Ouija* board, she found out that her uncle would be returning from France after WWI, and was able to describe his cabin and exactly when he would land and call. One time, when I was in the middle of the most upsetting moment of my life, she called and asked what was wrong. That was the only time she ever did that.

One day, a couple of years after her mother, Netta, had died, mother was washing the dishes and one of the elastic straps holding her stretch pants down suddenly broke. She thought, "Oh, darn! I'm going to have to drive down to Littleton and get a new elastic."

When she finished the dishes she sat down to rest and read a little. But it was kind of cool, so she decided to go out to the barn and see if she could find a shawl in Netta's clothes trunk. She dug down into the trunk and found the shawl. When she shook it out, an elastic strap fell to the floor. "Hmm," she said. "Netta, are you trying to tell me something?"

She went back to the house and sat down again to read. But none of the magazines looked interesting. She suddenly got the notion to go back out to the barn and pick out a book at random from the old books in one of the cow stalls. These were books from her father-in-law's estate which had been moved to the barn and just left there.

She picked out a book with no title showing on the spine and went back to the house to read. The book turned out to be a 1920 book, *Neither Dead Nor Sleeping*, by Mae Sewall, with an introduction by Booth Tarkington. The story it told gave my mother the answer to her question.

Mae Sewall, who was a world famous woman of her time in the woman's rights field, told about how her husband, after he'd died, contacted her to help her find several missing papers she needed. He then went on to set up a communications system and did experiments with his friend on the other side, the pianist Artur Rubenstein. It's a fascinating story and one of the best I've found about communicating with the dead. But it's obviously long out of print.

A few years ago I attended a lecture by Dr. Hal Huggins, the dentist who has been fighting the ADA over the use of amalgam fillings. I read his book, *It's All In Your Head*, and included it in my *Guide to Books*. Huggins had proven that the mercury from our fillings was poisoning us. Then I found Dr. Judd's *Good Teeth, Birth to Death*, which also damned mercury and the illnesses it causes.

The next step was when I was being interviewed by Art Bell on his talk show a couple years ago and I pointed out that good health depends a good deal on our not poisoning our bodies with stuff like mercury. Art got all upset. His dentist had assured him that amalgam fillings were harmless and he believed her. Serendipity stepped in when two dentists called the show, both confirming what I was saying.

More serendipity when a book arrived in the mail from Dr. Lydia Bronte, *The Mercury In Your Mouth*. This, too, immediately was added to my *Guide to Books*. I sent Lydia a copy of my *Guide to Books* and she called to say that someone sure ought to get busy and reprint some of the seriously out of print books I'd reviewed. I agreed, but said I just didn't have the time. Further, if I both recommended a book and sold it, that would be a conflict of interest. She said okay, she'd do it, which book would I recommend to start with. I looked through my *Guide* and decided the Sewall book would be the one which might do the most good for people.

I sent her a copy, she had it set in type, and printed up a short run to see how much interest there might be. When it's finished being bound it'll be $15, plus $3 s/h, from Quicksilver Press, 10 E. 87th, NYC 10128. I guarantee that this is a book that you'll treasure, plus be buying copies for any friends who have suffered a loss.

In the Sewall book, every time Artur Rubenstein needed her to make a major expenditure for his experiment, those on "the other side" arranged in some way for her to get a well-paying lecture tour.

How much of what we think of as serendipity actually has been organized by those on "the other side"? There are a couple of books reviewed in my *Guide to Books* which cite some incredible "coincidences." Things which have no logical explanation.

Reports from "the other side" try to explain to us that time is different there. It isn't linear as we experience it, so they're somehow able to arrange things so they'll happen in our time stream for us. Our past, present and future are just another dimension for them — which puts a different aspect on our birth and death.

When something serendipitous happens, try not to ignore it. Follow it up and take advantage of the serendipity.

The Raw Facts

Here I go, talking about health again. Well, I keep seeing that long list of Silent Key awards in *QST* every month and I'm now convinced that virtually every one of those guys would still be alive and polluting our bands with vacuous nonsense if only I'd managed to get through to them.

This conviction was reinforced by the arrival of a book from two of the authors of *Nature's First Law: The Raw-Food Diet*. Having already been convinced of the power of raw food to cure almost anything by Dr. Bruno Comby and his *Maximize Immunity*, plus the writings of Dr. Henry Beier, this new book just further reinforced my conviction. Plus, the whole concept makes perfect sense. I like it when theories make sense.

What all these experts are saying is that if you change to eating all raw food you're going to get over any illnesses you have. You won't get any new illnesses. And you'll be able to live in excellent health to 120 and even 150 years.

How come? Just think about it. Our bodies were developed millions of years ago when all everyone ate was raw food. It wasn't until we invented cooking that we began to get sick and die early.

Dr. Comby has been rescuing his patients from near death due to cancer, AIDS, and so forth, just by changing their diet to all raw food. The *Nature's Law* guys have a similar string of successes.

This is a tough change to consider. Sure, there's lots of raw food available. But darned few restaurants serve much, so if you go out to eat very often you are going to have a major problem.

Eating bananas, oranges, apples, grapes, melons, grapefruit, cherries, and so on is easy. Raw vegetables are more of a problem. Salads are easy. I've been

eating a big bowl of salad for both lunch and dinner for a long time now. Spinach, beet greens, watercress, bean, clover and alfalfa sprouts, with a few raisins make a great salad.

I've found that when I chop up raw broccoli, cauliflower and carrots that the mixture, with a little coleslaw sauce on it, is fine. Raw cabbage with the sauce on it is good, too.

But after have eaten cooked food for a lifetime, it's difficult to just stop. You see, there's this little Chinese restaurant in Hillsboro with a fabulous buffet lunch. Sigh. And a slice of pizza now and then? The ads for the Taco Bell pocket sandwiches looked so inviting on TV, but when we tried a couple one evening, what we got looked nothing like the ads. Ugh. Those big overstuffed TV sandwiches had very little in them when the real world struck. The only thing that was the same was the price.

Instead of a bowl of hot cereal for breakfast, now I'm eating three bananas or three oranges. For lunch a tomato, a big bowl of salad, and a bowl of chopped raw veggies. Dinner is about the same as lunch. But Sherry still wants to go out and eat. There isn't any way to get her to eat raw stuff. Or even fruit or vegetables, for that matter. I'll bet I'll have the same success with you. Sigh. You'd rather die than change your diet. So who wants to live to 150 anyway? My bet is that you'll continue to eat what tastes good and go to the doctor for repairs when your body starts breaking down — turning the responsibility over to him.

When you go raw you'll find that you can eat all you want and your big fat gut will gradually go away, replaced by muscles. You'll automatically get down to your normal body weight. Stuff like asthma, arthritis, diabetes, allergies, and so on will blow away. You'll find your body rebuilding itself, and you'll be full of energy and enthusiasm. Or you can continue your present slide into the obits and a Silent Key listing.

I've been promised an uncook book that'll explain how I can enjoy raw potatoes, beets, onions, and other such vegetables. I've always preferred my cooked veggies *al dente*, so now I'll change to super *al dente*.

If you're game to expose yourself to a powerful polemic — verbal overkill on the subject — invest $15, plus $3 s/h, for a copy of *The Raw Food Diet*, sent to Nature's First Law, Box 900202, San Diego CA 92190, or call 800-205-2350. If you can read this book and not change your diet, you've got more resistance to common sense than I.

Small Biz

New small businesses are thriving in Europe, helping to reduce their serious unemployment situation, and bringing new life to their economies. While the large businesses have been cutting payrolls by 4% a year, these new small businesses have been adding employees at the rate of 16%.

I wish I had the time to organize a lecture tour of Europe, including visits to their heads of state, so I could explain the benefits of setting up my new style of business incubators. I've written about this in my past editorials, and my system is explained in detail in my book *24 Ways to Improve State Government* ($5). This tells how business incubators can be set up in any town which will help fund and guide the growth of new small businesses.

Large businesses are moving their manufacturing to the least expensive countries and replacing much of their middle management with information systems (a.k.a. computers), so we can't look for job growth there for either blue or white collar workers. Worse, large businesses tend to be predatory, looking always for growth by swallowing up smaller businesses, and to have the political clout to get away with almost anything they want.

The health of any country increasingly is dependent on the growth of entrepreneurial businesses — and my incubator system makes their successful startup simple.

Our states and other countries could do worse (and will) than set aside a fund for business incubators to draw on. It would be a profit-making no-lose fund and would result in more jobs and increased business revenues.

Funny Coincidence

A number of scientists have been claiming that nuclear bomb tests, even when underground, can have some long range effects. In mid-May India tested five nukes. A few days later a killer heat wave hit India and Pakistan, killing scores. A few days later the high pressure blockage of winds over India brought massive flooding to China, killing 128.

The next day Pakistan tested five nukes. The day after that 366 died from the most devastating heat wave that had hit India in years. And the day after that an earthquake hit nearby Afghanistan, killing 2,500. The next day another heat wave hit India, killing 100 more.

Four days later the heat waves in India and Pakistan had killed over 1,300 people. The same day tornadoes hit all across the USA, including one in Antrim NH, just a couple miles from where I live.

A week later the India/Pakistan heat death toll was up to 2,500, with still more flooding in China.

In some way the global weather patterns seem to have been affected by the nuclear tests. So much for messing with Mother Nature.

Headstart

The governor of New Hampshire has been pushing hard to have all NH schools start with kindergarten when kids are five years old. She was pushing this agenda when she and I were on the Economic Development Commission Education Subcommittee a few years ago, and she was as impervious to facts then as she is now. Her mind is made up and facts are only a nuisance.

As Thomas Sowell says, "It's amazing how much time and ingenuity people will put into defending some idea that they never bothered to think through at the outset."

Headstart was supposed to give disadvantaged kids a better chance of getting an education. With 2000 agencies and 36,000 classrooms, it's been an expensive experiment. The long-term effects of Headstart have been carefully researched. They found no long-lasting effects on IQ, teen pregnancy, welfare, crime, later economic success, etc. The only people who benefited were the Headstart employees and administrators.

When the National Research Council of the National Academy of Sciences reviewed every post-secondary training program of the last 20 years they found that none of the programs worked. Billions of your money have been wasted.

More Headstart programs? More social spending? I sure hope you'll do your best to stop these wastes of money.

The Swedish, whose students outperform ours by a wide margin, don't start school until they are seven years old.

Nursing Homes

Did you bother to read some of the horror stories in the news media citing recent studies of nursing homes? It makes grim reading, with beating, malnutrition, dehydration and neglect being more the rule than the exception. The nursing home industry is powerful and seems to have control over the state overseers, according to a *Time* magazine Aug. 3rd issue report on California homes. What they found was just awful. Yet, that's where a high percentage of you are headed unless you change your diet.

Indians

The Indians have been doing well by setting up casinos on their reservations. I'm seeing more and more ads on TV by these casinos, so it's obviously a thriving business. Take

the Foxwood Casino in Connecticut. Less than 15 years ago there were only three people living on the reservation. Now they've got gaming revenues of over a billion dollars and the tribe has expanded to 260.

The Indians are complaining that the Europeans came in with higher technology and took their country away. Well, they're right, that's what happened. But the same thing has been happening all through history. The guys with the bigger and better clubs win and take over. The Jews did it when they pushed the Arabs aside and formed Israel. Israel then took the West Bank away from Jordan with their army; they've kept it, and don't seem to be much interested in giving it back.

It was their higher technology that allowed the European countries to take over most of Africa and big lumps of Asia. Through massive mismanagement they've managed to lose most of it. They did the same thing in the Caribbean, with England controlling most of the islands, the French a few, and the Dutch a few. Spain was doing fine until the US shoved 'em out.

All the people who are begging for peace should take a good long look at history and see if they can find any instance where might didn't make right. When you lay your weapons down you are doing it to grab for a yoke to wear. And today, technology is providing us with the bigger club.

Schools

A review of a book by Fred Holden had this quote: "Our system of education teaches just about everything except the three things that matter most — How to make a living, how to live, and how to understand life, especially in areas of economics and politics."

Since, if our schools did teach these basic concepts, our country and our lives might be vastly different, I wonder if the neglect of these subjects is entirely accidental. These are exactly the things I've been writing about, but I should be writing for kids instead of old people whose minds are so closed that the light of reason is unable to penetrate the gloom. Well, I may be exaggerating, but that's the impression I get much of the time.

As far as living successfully and making a good living are concerned, around 90% of the stuff that is "taught" in high school and 100% of college is a waste of time. That was my experience, and things were supposedly a whole lot better those days than now.

Most of what I was taught in science classes has subsequently been proven wrong. Most of the math I suffered through has never been of any real use, and I've been involved with a lot of different businesses. The English literature classes were a huge waste of time. And so it went. Humbug!

Wagging the Dog

It's my fault. I haven't been ragging you lately to subscribe to *The New Yorker* so you wouldn't miss the outstanding articles they manage to come up with. Like the one in the October 12th issue, *The Missiles of August*, subtitled, "The Annals of National Security." It had to do with the missile attack, just three days after Clinton's grand jury testimony about his affair with Monica Lewinsky, on the pharmaceutical factory in Sudan. The attack was claimed to be in retaliation for the truck bombings of the American embassies in Kenya and Tanzania.

The article quoted American businessman Bobby May, who was in Khartoum at the time of the attack. He was very surprised because he and Bishop Brookings (from Nashville) had just visited the factory a few days before and had been shown every part of the operation. The place was a showplace, where kids routinely toured the plant, and not, as the White House spokesman claimed, a heavily guarded chemical factory.

The net result of the use of $60 million of Tomahawk missiles was the destruction of a badly needed pharmaceutical factory in Khartoum, a mess in Afghanistan, no one important killed, and an enormous buildup of resentment through the whole Arab world. Well, it did keep Monica out of the headlines for a few days, so perhaps the White House strategists felt it was worth the expense.

By the way, as you read the article, you'll see that the Joint Chiefs were not consulted before the attack. You'll also probably not be particularly surprised that the intelligence reports which were cited by the White House as an excuse for the attack were of the usual low grade in accuracy.

A propos, I'm enjoying a discounted book ($8) published by Barnes & Noble, *Senseless Secrets*, by Lt. Col. Michael Lanning — subtitled, "The Failures of US Military Intelligence from George Washington to the Present." You no doubt have suspected that, being government agencies, our intelligence departments were probably bungling almost everything they've been doing. What I doubt you've suspected is the extremes that this bungling has often reached. Pester B&N and spend the $8. You're going to be highlighting the hell out of the book and reading sections to anyone who will listen. The author said he'd spent several years as an

Continued on page 64

PROPAGATION

Number 62 on your Feedback card

Jim Gray W1XU/7
210 E Chateau Circle
Payson AZ 85541
[jimpeg@netzone.com]

The HF bands in August and September were quite good at times, with DX rolling in on frequencies in the bands between 40 and 10 meters. At one point the solar flux rose to 176—the highest I've seen it since Cycle 22—which is a good sign, but requires a word of caution.

Cycle 23 is likely to provide the lowest peak solar flux value of the last few cycles. One forecaster predicts that the peak will occur in 1999, which I believe is a year or two early, if everything proceeds normally. But nothing about Cycle 23 has been "normal," so it's possible he could be right. We'll just have to wait and see.

Propagation this month is likely to be *irregular* because December is traditionally a month when HF propagation is seasonally low, and we haven't yet seen consistently high solar flux values during this cycle. Therefore, use the calendar to pick the best days (G) for your efforts, but always listen and make a few calls into the void on other days, too, because the universe is full of surprises.

10–12 meters

Possible openings to Europe in the morning, midday openings to Africa and South America, and late afternoon openings to Australasia and the South Pacific. Daytime short-skip openings between 1000 and 2000+ miles are likely as well.

15–17 meters

Worldwide DX possible during daylight hours, peaking toward Europe and the east in early morning, toward the southern hemisphere in the afternoon, and toward the west, South Pacific and Australasia in the late afternoon, with daytime short skip from 1000 to over 2000 miles.

20–30 meters

Openings to Europe and the east during late afternoon hours, with the bands remaining open to various areas of the world during hours of darkness until shortly after sunrise. Daylight short skip to 1000 miles and 2000 miles or so at night.

40 meters

Generally low noise prevails, and openings toward Europe and the east beginning in late afternoon, with the band remaining open all night until after sunrise to various areas of the world. Daytime short skip to about 1000 miles and over 1000 miles at night. This *could* be your best DX band this month!

80 meters

DX to all areas of the world between dark and dawn with signals peaking toward Europe and east around midnight, and to other directions just before dawn. Daytime short skip to 500 miles and nighttime openings to 2000 miles or so.

160 meters

DX possible during early evening and hours of darkness. No daytime short skip, but excellent possibilities at night from 500 to about 1500 miles.

Don't forget to work the *darkness path* (±30 minutes around local sunset).

Check the bands above and below the suggested ones for possible DX surprises. It's often a good idea to park your receiver on a seemingly unused frequency and just wait. A DX station is very likely to pop up before any one else hears him, and you can snag a good catch. 73, W1XU/7.

December 1998

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G-F	2 F	3 F-P	4 P	5 P-VP
6 VP	7 P	8 P-F	9 F	10 F-G	11 G-F	12 F-P
13 P-F	14 F	15 F-G	16 G	17 G	18 G-F	19 F
20 F-G	21 G-F	22 F-P	23 P	24 P-VP	25 P	26 P-F
27 F-G	28 G-F	29 F	30 F	31 F-P		

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20					20	20				15
ARGENTINA	20	40	40	40			20	15	15	10	10	15
AUSTRALIA	15	20	20		40	40	40			20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40	40		20	15	10	15	20	20	
HAWAII	15	20					20	20	20	10	10	15
INDIA							20	20				
JAPAN	15	20					20	20				15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES							20	20				
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
RUSSIA (C.I.S.)							20	15	20	20		
SOUTH AFRICA	20	40					20	10	10	10	15	20
WEST COAST	15/20	20/40	80	160	160	160				10	10	15

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15							20				15
ARGENTINA	20	20	20	40	40		20	20	15	10	15	15
AUSTRALIA	15	20	20				40				15	10
CANAL ZONE	15	20	40	40	40		20	15	10	10	10	15
ENGLAND	40	40	80					20	15	15	20	40
HAWAII	15	20		40	40	40	40	20	20	15	10	15
INDIA								20				
JAPAN	15							20				15
MEXICO	15	20	40	40	40		20	15	10	10	10	15
PHILIPPINES	15	20						20				15
PUERTO RICO	15	20	40	40	40		20	15	10	10	10	15
RUSSIA (C.I.S.)								20	15	20		
SOUTH AFRICA	20	40						15	10	10	15	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	15	20				40	40	40			20
ARGENTINA	15	20		40	40			20		10	10	15
AUSTRALIA	10	15	20	20			40	40	20	20	15	15
CANAL ZONE	15	20	20					20	15	10	10	10
ENGLAND	20	40	40						15	15	20	20
HAWAII	10	15	20	40	40	40		20	20	15	15	10
INDIA		15	20						20			
JAPAN	10	15	20				40	40	40			20
MEXICO	15	20	20					20	15	10	10	10
PHILIPPINES	10	15/20	15/20			40	40	40		20		20
PUERTO RICO	15	20	20				40	40	40			20
RUSSIA (C.I.S.)									20	20		
SOUTH AFRICA	20	20							15	10	15	15
EAST COAST	15/20	20/40	80	160	160	160				10	10	15

Here are some of the books Wayne has written. Some can change your life, if you'll let them. If the idea of being healthy, wealthy and wise is of interest to you, start reading. Yes, you can be all that, but only when you know the secrets which Wayne has spent a lifetime uncovering.

Radio Bookshop

The Secret Guide to Health: Yes, there really is a secret to regaining your health and adding 30 to 60 years of healthy living to your life. The answer is simple, but it means making some very difficult changes. Will you be skiing the slopes of Aspen with me when you're 90 or doddering around a nursing home? Or pushing up daisies? No, I'm not selling any health products. $5 (H)

The Secret Guide to Wealth: Just as with health, you'll find that you have been brainwashed by "the system" into a pattern of life that will keep you from ever making much money and having the freedom to travel and do what you want. I explain how anyone can get a dream job with no college, no résumé, and even without any experience. I explain how you can get someone to happily pay you to learn what you need to know to start your own business. $5 (M)

The Secret Guide to Wisdom: This is a review of around a hundred books that will help you change your life. No, I don't sell these books. They're on a wide range of subjects and will help to make you a very interesting person. Wait'll you see some of the gems you've missed reading. $5 (B)

Cold Fusion Overview: This is both a brief history of cold fusion, which I predict will be one of the largest industries in the world in the 21st century, plus a simple explanation of how and why it works. This new field is going to generate a whole new bunch of billionaires, just as the personal computer industry did. $5 (C)

The Bioelectrifier Handbook: This explains how to build or buy a little electrical gadget that can help clean the blood of any virus, microbe, parasite, fungus or yeast. The process was discovered by scientists at the Albert Einstein College of Medicine, patented, and then hushed up. It's curing AIDS, hepatitis C, and a bunch of other serious illnesses. The circuit can be built for under $20 from the instructions in the book. $10 (A)

Moondoggle: After reading René's book, *NASA Mooned America*, I read everything I could find on our Moon landings. I watched the videos, looked carefully at the photos, read the astronaughts' biographies, and talked with some of my readers who worked for NASA. This book cites 25 good reasons I believe the whole Apollo program had to have been faked. $5 (D)

Mankind's Extinction Predictions: If any one of the experts who have written books predicting a soon-to-come catastrophe which will virtually wipe us all out are right, we're in trouble. In this book I explain about the various disaster scenarios, from Nostradamus, who says the poles will soon shift, wiping out 97% of mankind, to Sai Baba, who has recently warned his followers to get out of Japan and Australia before December 6th this year. The worst part of these predictions is the accuracy record of some of the experts. Will it be a pole shift, a new ice age, a massive solar flare, a comet or asteroid, or even Y2K? I'm getting ready, how about you? $5 (E)

Wayne's Submarine Adventures in WWII: Yes, I spent from 1943-1945 on a submarine, right in the middle of the war with Japan. We almost got sunk several times, and twice I was in the right place at the right time to save the boat. What's it really like to be depth charged? And what's the daily life aboard a submarine like? There are some very funny stories. If you're near Mobile, please visit the Drum. $5 (S)

Improving State Government: Here are 24 ways that almost any state government can cut expenses enormously, while providing far better services. I explain how any government bureau or department can be gotten to cut its expenses by at least 50% in three years and do it cooperatively and enthusiastically. I explain how, by applying a new technology, the state can make it possible to provide all needed services without having to levy *any* taxes at all! Read the book, run for your legislature, and let's get busy making this country work like its founders wanted it to. Don't leave this for "someone else" to do. $5 (L)

Travel Diaries: You can travel amazingly inexpensively – once you know the ropes. Enjoy Sherry and my budget visits to Europe, Russia, and a bunch of other interesting places. How about a first class flight to Munich, a rented Audi, driving to visit Vienna, Krakow in Poland (and the famous salt mines), Prague, back to Munich, and the first class flight home for two, all for under $1,000. Yes, when you know how you can travel inexpensively, and still stay in first class hotels. $5 (T)

Wayne's Caribbean Adventures: More budget travel stories – where I visit the hams and scuba dive most of the islands of the Caribbean. Like the special Liat fare which allowed us to visit 11 countries in 21 days, with me diving all but one of the islands. Guadeloupe, where the hams kept me so busy with parties I didn't have time to dive. $5 (U)

Silver Wire: With two 3" pieces of heavy pure silver wire + three 9V batteries you can make a thousand dollars worth of silver colloid. What do you do with it? It does what the antibiotics do, but germs can't adapt to it. Use it to get rid of germs on food, for skin fungus, warts, and even to drink. Read some books on the uses of silver colloid, it's like magic. $15 (Y)

Classical Music Guide: A list of 100 CDs which will provide you with an outstanding collection of the finest classical music ever written. This is what you need to help you reduce stress. Classical music also raises youngsters' IQs, helps plants grow faster, and will make you healthier. Just wait'll you hear some of Gotschalk's fabulous music! $5 (Z)

Reprints of My Editorials from *73*.

Grist I: 50 of my best non-ham oriented editorials from before 1997. $5 (F)

Grist II: 50 more choice non-ham editorials from before 1997. $5 (G)

1997 Editorials: 240 pages, 216 editorials discussing health, ideas for new businesses, exciting new books I've discovered, ways to cure our country's more serious problems, flight 800, the Oklahoma City bombing, more Moon madness, and so on. In three $5 volumes. $15 (O)

1998 Jan-Aug Editorials: 188 pages in two $5 volumes. Bringing you up to date. $10 (P)

Ham-to-Ham: 45 of my ham-oriented editorials. These will help you bone up on ham history. Great stuff for ham club newsletter filler. Yes, of course these are controversial. $5 (Q)

$1 Million Sales Video: How to generate extra million in sales using PR. This will be one of the best investments your business ever made. $43 (V)

One Hour CW: Using this sneaky method even *you* can learn the Morse Code in one hour and pass that dumb 5wpm Tech-Plus ham test. $5. (CW)

Code Tape (T5): This tape will teach you the letters, numbers and punctuation you need to know if you are going on to learn the code at 13 wpm or 20 wpm. $5 (T5)

Code Tape (T13): Once you know the code for the letters (T5) you can go immediately to copying 13 wpm code (using my system). This should only take two or three days. $5 (T13)

Code Tape (T20): Start right out at 20 wpm and master it in a weekend for your Extra Class license. $5 (T20)

Code Tape (T25): Same deal. It doesn't take any longer to handle 25 wpm as it does 13. Or use the ARRL system & take six months. $5 (T25)

Wayne Talks at Dayton: This is a 90-minute tape of the talk I'd have given at the Dayton, if invited. $5 (W1)

Wayne Talks at Tampa: This is the talk I gave at the Tampa Global Sciences conference. I cover cold fusion, amateur radio, health, books you should read, and so on. $5 (W2)

Stuff I didn't write, but you need:

NASA Mooned America: René makes an air-tight case that NASA faked the Moon landings. This book will convince even you. $25 (R1)

Last Skeptic of Science: This is René's book where he debunks a bunch of accepted scientific beliefs – such as the ice ages, the Earth being a magnet, the Moon causing the tides, and etc. $25 (R2)

Elemental Energy Subscription: I predict this is going to be the largest industry in the world in about 20-30 years. They laughed at me when I predicted the personal computer growth in 1975. PCs are now the third largest industry in the world. The elemental energy ground floor is still wide open, but then that might mean giving up watching ball games and talk shows on the boob tube. $30 for six issues. (EE). A sample issue is $10.

Three Gatto Talks: A prize-winning teacher explains what's wrong with American schools and why our kids are not being educated. Why are Swedish youngsters, who start school at 7 years of age, leaving our kids in the dust? Our kids are intentionally being dumbed down by our school system — the least effective and most expensive in the world. $5 (K)

......Wayne

Radio Bookshop

70 Hancock Road, Peterborough, NH 03458

Name ____________ **Call** ________ **Phone** ________

Address ____________________

City-State-Zip ____________________

Items ordered - use letters or copy page and mark books wanted. Order total plus $3 s/h in US,$6Can.

____________________ US$________

Foreign orders: $10 s/h surface shipping. Lord knows what airmail will cost – make a good guess
Allow 4 weeks for delivery except foreign, though we try to get most orders shipped in a day or two.

MC/Visa for orders over $10. # ____________________ Expire ______

Phone orders: 603-924-0058 • 800-274-7373 • fax: 603-924-8613

Yes! Put me down for a year of *73* for only $25 (a steal). Canada US$32. Foreign US$44 by sea, US$67 by air. Whew!

Barter 'n' Buy

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it, rather than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73* Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial!) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to: *73 Magazine*, Barter 'n' Buy, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls. The deadline for the March 1999 classified ad section is January 10, 1999.

NEVER SAY DIE

continued from page 61

officer during the war in Vietnam and had never gotten one useful piece of information from any of the intelligence agencies. Army Intelligence truly is a contradiction of terms.

Too bad if you missed the *New Yorker* article. This was the magazine that forced the AMA to admit that ulcers are caused by the *Heliocobacter Pylori* germ and could be cured quickly with antibiotics, news that has cost the medical establishment billions of dollars in endless doctor visits for the old ineffective ulcer treatments. On the positive side, a recent survey showed that thousands of doctors are still happily unaware of the new treatment — and probably intend to stay unaware of it.

Sporadic E

A note from Neil Spokes AB4YK points out that sporadic E is anything but sporadic, in the sense of being non-predictable. These events repeat every year, over and over, on the same days. Thus they must be tied into where the Earth is in its orbit, going through something — perhaps a cometary effect.

My Ballot

The Official ARRL Ballot, allowing me to vote for the Vice Director, arrived. Apparently no one was interested enough in the job to run for Director, so our old used Director is holding down the spot for two more years. I looked over the promotions for the two contestants for Director of Vice. One was Andrea Parker K1WLX. Her promotion told all about her marvelous accomplishments, but said nothing about how I or even the hobby might benefit from her important self being elected. Also, she was not smiling in her photo. Her look said to me that she's very, very important and I'm an insignificant something that probably stuck to someone's shoe.

The opponent in the election was Michael Raisbeck K1TWF. His piece was almost all about the things he wanted to do to make the hobby better, with just a short paragraph at the end about himself. And he was smiling in his photo.

Care to guess who I voted for? Make a wild stab.